

CONTENTS

No. 1, September, 1936

[Issued November 5, 1936.]

	Page
ROSELL, D. Z., and A. S. ANDRILLAS. Hell types and growth of abalone in basipan fishponds	1
SKVORTZOW, B. W. Diatoms from Kisaki Lake, Honshu Island, Japan	9
Between plates.	
TUBANGUI, Marcos A., and VICTORIA A. MABILUGAN. Oöchoristica exsiccata, a new reptilian ectoparasite.	75
One text figure.	
BEINHAUER, MAX. Die Staphyliniden der Philippinen (Gattung <i>Oxytelus</i>)	81
GREASHAM, LINSEY J. New longicorn beetles from Formosa, III: (Coleoptera: Cerambycidae)	89
One plate.	
ALEXANDER, CHARLES P. New or little-known Tipulidae from eastern Asia (Diptera), XXXII	113
Two plates.	
BOOKS	151

No. 2, October, 1936

[Issued December 15, 1936.]

CRUZ, ATRELIO O., and AUGUSTUS P. WEST. Composition of Philippine tobacco-seed oil	161
ALEXANDER, CHARLES P. New or little-known Tipulidae from eastern Asia (Diptera), XXXIII	169
Two plates.	
BATAS, F. E. Notes on Philippine mosquitoes, II: The pupal characters of anophelines of the subgenus <i>Nyssomyia</i>	205
Twenty-five plates.	
AFRICA, CANDIDO M., PEDRO G. RAPUNZO, and EUSEBIO Y. GARCIA. Further observations on the life cycle of <i>Gnathostoma spinigerum</i>	221
AFRICA, CANDIDO M., WALTERIO DE LEON, and EUSEBIO Y. GARCIA. Somatic heterophyldiasis in fish-eating birds, II: Presence of adults and eggs in the bile ducts of the cattle egret	227
Two plates.	

	Page
BARTRAM, EDWIN B. Bornean mosses, principally from Mount Kinabalu	215
One plate.	
SKVORTZOW, B. W. Diatoms from Biwa Lake, Honshu Island, Japan	253
Eight plates.	
BOOKS	297
No. 3, November, 1936	
(Received December 16, 1936)	
MERINO, GONZALO. Philippine Ciendellike (Homoptera)	303
Four plates.	
No. 4, December, 1936	
(Received January 23, 1937)	
YETUC, LORE M. Experimental studies on the curative treatment of surra in native horses in the Philippines, II	301
YENKO, F. M., and LUZ RAENS. Tannin content of Philippine oak barks	315
RAENS, Luz, and F. M. YENKO. Effect of molds on some Philippine tanning liquors, II	317
Four text figures.	
TANCHICO, SIMEONA SANTIAGO, and AUGUSTUS P. WEST. Philippine annatto dye as a coloring matter	329
Three plates.	
CRUZ, AURELIO O., and AUGUSTUS P. WEST. Composition of Philippine physic-nut oil	337
Three plates.	
MEYERS, ROLLIN G. An improved Jones reductor	447
One plate.	
JULIANO, JOSE B., and EDUARDO QUISUMBIDA. Floral mechanism in <i>Stereulia apetala</i> (Jacquin) Kunsten	451
Four plates.	
ARTNER, J. C., and GEORGE B. CUMMINGS. Philippine rusts in the Clemens collection 1923-1926, II	463
Four plates.	
ALCASID, GONZALO L. Philippine recent shells, I	489
Two plates.	
Books	501
INDEX	511

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No. 1

SOIL TYPES AND GROWTH OF ALGAE IN BANGOS FISHPONDS

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In the Philippines the commonest edible fish is the bangos (*Chanos chanos* Forskål). The cultivation of this fish in ponds has been developed extensively, especially around Manila Bay.

Bangos are essentially vegetarians. Their food consists principally of various species of algae, known locally as lumut. When the supply of lumut is abundant the fish thrive and grow rapidly. Although hydrophytic in character these plants get part of their subsistence and anchorage from the soil.

This paper gives the results of a preliminary investigation to determine the types of soil found in some bangos ponds and to ascertain their relation to the growth of the algae.

HORIZONS OF FISHPOND SOILS

Soils that have water as the principal gross component were designated by Veatch as hydrosols. He classified such soils into four major morphologic horizons; namely, aqueous, subaqueous, and basal horizons in addition to the subbasal geologic substratum.

The hydrosols of the bangos ponds around Manila Bay belong, in general, to the lacustrine group of shallow saline aqueous horizons. The depth of the aqueous horizon ranges from 20 centimeters in Cavite Province to 110 centimeters in Pampanga.

Aqueous horizon.—The first major horizon consists of the surface water, which is the "A_n" horizon of the normal soil

profile. Its importance lies in the fundamental requirements of many aquatic plants, which live almost entirely in a medium of water. Salinity, hardness, solids in suspension, and depth of the water are the most important factors in this zone.

Subaqueous horizon.—The second major horizon, the mud portion, is the "A" horizon in the normal soil profile. This is the anchorage place for most of the aquatic plants and a source of their nutrients. The physical properties and chemical composition of the soil in this zone naturally affect the growth of the plants.

Basal horizon.—The third major horizon is the "B" horizon in the normal soil profile. This is not as important as the subaqueous horizon. However, when the first and second horizons are shallow, its importance becomes quite significant.

Subbasal geologic substratum.—This is the "C" horizon in the normal soil profile. The character of the basal horizon is more or less dependent upon the geologic formation of this subbasal horizon.

SOIL TYPES OF SUBAQUEOUS HORIZONS

Field observations and the collection of soil samples of subaqueous horizons were made in four provinces bordering on Manila Bay; namely, Bataan, Pampanga, Rizal, and Cavite. All the samples were obtained from representative bangos ponds by means of a post-hole digger. The growth of algae, where the samples were taken, was carefully noted.

There were 6 samples collected from Bataan, 11 from Pampanga, 4 from Bulacan, 8 from Rizal, and 4 from Cavite, making a total of 33 soil samples. The number and location of the samples are recorded in Table I. The description and relative growth of algae are given in Table 2.

Soil samples of the subaqueous horizons of the different fishponds were classified according to definite soil types as follows:

Type 1.—Peaty clay either compact or matted in structure. Samples 11, 16, 17, 18, and 25.

Type 2.—Peaty clay either soft or fluid in consistency. Sample 23.

Type 3.—Slimy clay, slightly organic and gelatinous in consistency. Samples 9, 13, 14, 19, 21, and 33.

Type 4.—Clay-colloid, largely inorganic, containing either dark-colored, grayish green, or reddish mud. Samples 10, 15, 26, 27, 36, and 40.

TABLE I.—Location of soil samples of the subaqueous horizon.

Sample No.	Place.	Pond No.	Remarks.
1	Sitio San Roque, Bulacan, Bulacan	1	
3	do	2	
4	do	1	
6	do	3	
7	do	2	
8	Puerto River, Bulacan, Bulacan		Neer the sea.
9	Guagua, Pampanga	8	
10	do	1	
11	San Juan, Pampanga	2	
12	Batas, Pampanga	3	
14	do	1	
15	do	1	
16	Hacienda San Esteban, Macabebe, Pampanga	10	
17	do	16	
18	do	14	
19	do	3	
21	do		Lot 1 A.
23	Hacienda Sapang Cauayan, Nagcarlan, Batcaan		Lot 3 A.
25	do		Lot 4 A.
26	do		Lot 2 A.
27	Hambag, Bulacan, Bulacan	1	
29	Caloocan, Rizal	4	
30	do	3	
31	do	5	
32	Longos, Malabon, Rizal	1	
33	Paranaque, Rizal	1	
34	do	1	
35	Las Piñas, Rizal	1	
36	do	1	
37	Bacoor, Cavite	1	
38	Datalinan, Navotas, Cavite		By the sea.
40	do		No.
42	do		Puddic.

Type 5.—Fine sandy mud, sand-organic matter admixed. Samples 4, 6, 7, 32, 35, 38, and 42.

Type 6.—Sandy mud, sand-shell admixed. Samples 1, 3, 8, 29, 30, 31, and 37.

Type 7.—Sand, clean sand compact. Sample 34.

There is a wide range of texture and consistency in the subaqueous horizons of the different fishponds around Manila Bay. Fishponds in Pampanga and Bulacan Provinces, along Pampanga and Guagua Rivers, have subaqueous horizons of fine texture consisting mostly of clay with decayed trunks, leaves, and roots of the nipa palm. This is particularly true of the ponds at the Hacienda San Esteban of the Ayala Company and the Hacienda Sapang Cauayan of the La Tondeña Company, which are in a nipa-palm region.

TABLE 2.—Descriptions of samples of brackish-pond soils and the growth of the algae where the samples were collected.

Sample No.	Depth of previous horizon, cm.	Depth of subaqueous horizon, cm.	Description of subaqueous horizon.	Description of topsoil horizon.	Growth of algae.
1	0-50	50-80	Brown and nearly black; very fine sandy mud, largely inorganic.	Dark gray sand.	Few.
2	0-50	50-80	Very dark brown; very fine sandy mud, largely inorganic.	Dark gray muddy sand.	Do.
4	0-50	50-80	Black; very fine sandy peat, mud; with few remains of sago palm.	Black sand.	Abundant.
6	0-50	50-100	Very dark gray; very fine sandy mud; largely loamy.	Dark gray muddy sand.	Do.
7	0-50	50-100	Dark gray; very fine sandy mud; largely loamy.	Dark brown sandy mud.	Do.
8	0-40	40-80	Dark brown to black; peaty mud with partially decomposed sago palm; largely inorganic.	Dark brown sandy mud.	Few.
9	0-60	60-100	Black; muddy clay; largely inorganic with marine shells.	Very dark brown to black clay soil.	Very abundant.
10	0-40	40-70	Very dark brown to black; slightly silty clay with marine shells.	Dark brown muddy clay.	Abundant.
11	0-40	40-80	Dark brown to nearly black; peaty and muddy clay; partially decomposed sago palm.	Dark gray silty clay mud.	Very abundant.
12	0-30	30-80	Gray to dark gray silty muddy clay.	Dark gray muddy clay.	Do.
14	0-45	45-80	Black with gray muddy clay; largely inorganic.	Gray muddy clay.	Do.
15	0-70	70-100	Dark brown to dark gray muddy clay soil; largely loamy.	Dark gray muddy clay.	Abundant.
16	0-100	100-150	Dark gray peaty mud; mostly of decomposed sago palm.	reddish brown peaty mud; largely of sago leaves.	Very abundant.
17	0-60	60-100	reddish brown peaty and muddy clay loam with decomposed sago palm.	reddish brown peaty muddy clay.	Do.
18	0-100	50-100	Dark brown to reddish brown peaty mud with marine shells and decayed roots and leaves of sago palm.	reddish brown peaty mud; largely decayed roots and leaves.	Do.
19	0-60	50-100	Dark silty and muddy clay largely organic with marine shells compact.	Dark gray silty mud with decayed leaves and roots of sago palm.	Do.
21	0-10	10-50	Black and gray silty muddy clay; largely organic with marine shells compact.	reddish brown peaty mud largely organic; decayed roots and leaves.	Do.
23	0-60	60-100	Black peaty mud; largely of decayed remains of sago palm.	Mixture of gray and reddish brown peat mud with decayed remains of sago palm.	Abundant.
24	0-10	50-50	reddish brown silty muddy clay with decayed remains of sago palm.	reddish brown peaty mud largely of decayed sago-palm remains.	Very abundant.
26	0-40	40-50	Black silty mud with plenty of marine shells.	Brown mud largely loamy.	Abundant.

27	0-23	26-57	Very dark brown and black muddy clay; largely inorganic.....	Dark brown clay largely inorganic.....	Do.
29	0-53	58-100	Very dark brown to black; very fine sandy mud with marine shells.....	Brown sandy mud with few marine shells.....	Few.
30	0-50	50-92	Dark gray to black; very fine sandy mud, largely inorganic with marine shells.....	Dark brown clay mud.....	Do.
31	0-43	43-98	Dark gray very fine sandy mud with marine shells.....	Dark brown muddy sand.....	Do.
32	0-38	43-76	Dark gray to dark green sandy mud; compact.....	Gray muddy sand.....	Do.
33	0-43	43-104	Black silty muddy clay; largely inorganic; compact.....	Dark brown sandy mud.....	Very abundant.
34	0-36	83-98	Dark gray muddy sand with marine shells.....	Dark brown sand with marine shells.....	Very few.
35	0-48	45-71	Very dark gray mud; largely inorganic.....	Dark brown muddy sand.....	Few.
36	0-35	35-72	Very dark gray to nearly black silty muddy clay.....	Gray muddy clay.....	Abundant.
37	0-45	43-83	Black silty sandy mud; largely inorganic.....	Dark brown muddy sand.....	Few.
38	0-40	40-112	Very dark gray to nearly black; very fine silty sandy muddy clay loam; compact.....	Dark gray mud.....	Abundant.
40	0-40	40-99	Black; very fine silty muddy clay; largely inorganic.....	Dark gray peaty mud.....	Do.
43	0-20	20-32	Black silty sandy mud; compact.....	Dark gray to black sand.....	Do.

TABLE 3.—Average inconstant analyses of different types of subaqueous horizons and the growth of algae.

Type of subaqueous horizon	Coarse sand, 0.25 to 0.28 mm.	Medium sand, 0.02 to 0.14 mm.	Fine sand, 0.14 to 0.02 mm.	Very fine sand, 0.02 to 0.005 mm.	Silt, 0.005 to 0.0001 mm.	Clay, 0.0001 mm.	Solution loss ^a	Growth of algae
	Percent.	Percent.	Percent.	Percent.	Percent.	Percent.	Percent.	
1	0.7	7.5	4.4	7.1	17.4	60.0	20.4	Very abundant.
2	0.0	0.1	0.8	10.0	55.0	35.0	23.2	Abundant.
3	2.3	0.6	0.1	11.1	25.5	35.8	16.6	Very abundant.
4	0.11	4.0	0.6	7.7	20.0	47.0	11.2	Abundant.
5	33.0	0.0	0.9	14.7	12.2	29.1	4.7	Lie.
6	19.2	7.5	7.1	23.0	12.0	20.1	9.0	Few.
7	22.0	23.0	16.0	8.1	0.1	9.0	0.2	Very few.

^a The solution loss is obtained by treating the sample with hydrogen peroxide and washing.

Table 4.—Average chemical analyses of different types of subaqueous horizons and the growth of algae.

Type of subaqueous horizon	Nitrogen (NH_3)	Phosphoric anhydride (P_2O_5)	Potash (K_2O)	Organic matter,*	Growth of algae
	Per cent.	Per cent.	Per cent.	Per cent.	
1	0.346	0.136	0.345	24.48	Very abundant.
2	0.218	0.176	0.212	15.54	Abundant.
3	0.363	0.197	0.296	16.11	Very abundant.
4	0.285	0.135	0.160	12.38	Abundant.
5	0.119	0.086	0.564	9.30	Few.
6	0.098	0.107	0.264	7.78	Few.
7	0.051	0.167	0.139	5.75	Very few.

* Organic matter was obtained by the loss on ignition.

Bataan, Rizal, and Cavite Provinces have fishponds located near the sea with subaqueous horizons of varying texture depending upon the distance of the pond from the seashore and the type of soil in the immediate vicinity.

The subaqueous horizons of fishponds in Balanga, Bataan Province, consist mostly of fine sandy mud. In Malabon and Caloocan, Rizal Province, they are composed chiefly of fine sand. In Parañaque and Las Piñas, Rizal, they are a sandy mud that is black to dark gray in color; and in Bacoor and Noveleta, Cavite, they are also sandy mud.

EXPERIMENTAL PROCEDURE

Mechanical and chemical analyses were made of the individual soil samples included in each soil type. The analytical results of the samples included in each type were then averaged in order to get the mean results for each particular type.

Average mechanical analyses of the different types of subaqueous horizons are given in Table 3, and in Table 4 are given the average chemical analyses. Included in these tables are also notes on the growth of algae corresponding to various types of subaqueous horizons.

The mechanical analyses were made in accordance with the method of Olmstead, Alexander, and Middleton. The methods of the Association of Official Agricultural Chemists were used for the chemical analyses. The elements determined were nitrogen, phosphorus, and potassium. Organic matter was ascertained by the loss on ignition.

SUMMARY

A preliminary investigation of the soils of some fishponds bordering on Manila Bay was carried out.

Data from the mechanical and chemical analyses (Tables 3 and 4) indicate that, in general, algae seem to grow very abundantly in types of subaqueous horizons that have a high-solution loss and a high content of clay, nitrogen, and organic matter. Types that are deficient in these characteristics generally have very few algae.

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DIATOMS FROM KIZAKI LAKE, HONSHU ISLAND NIPPON

By B. W. SKVORTZOW

Of Harbin, Manchukuo

SIXTEEN PLATES

In presenting this list of the diatoms that I found in Kizaki Lake, Shinano Province, Honshu Island, Nippon, I wish to offer some general results of the investigation.

The diatom material was collected in July, 1927, by Mr. K. Kiuchi, and sent to me through the kindness of Prof. Dr. T. Kawamura, director of the Zoological Institute, College of Science, Kyoto Imperial University. The material consisted of a glass tube with mud from the lake. The crude material was first examined under the microscope, by the use of magnifying powers ranging from 100 to 600 diameters, and only a few diatoms were discovered. When the mud was prepared for accurate investigation I found thousands of siliceous algae. The material was boiled in commercial hydrochloric acid for one-half hour. The acid when cold was decanted, and the residue washed with water to get rid of the resultant salts. After a few days the material was boiled in concentrated commercial sulphuric acid for one-half hour, after which powdered potassium chlorate was slowly added to the boiling acid until the black color gave place to yellow. A week was spent in removing the traces of acids and salts from the material. The prepared diatoms were preserved in alcohol. The diatom material was mounted in coumarone-piperin and mercuric iodide (HgI_2), proposed by Dr. R. W. Kolbe. I have examined a hundred microscopic slides with apochromat 2 mm E. Leitz, Wetzlar, and compensating oculars 6, 8, and 12. Half a year was spent in the study of this collection.

The diatom flora of Kizaki Lake is rich. The slides examined yielded 338 forms, a list of which is given below. Diatoms, especially those living in fresh water, are known to be very cosmopolitan in their habitats. Nevertheless, there are certain species characteristic of alpine and Arctic regions, and others

of warm climates. The diatom flora of Kizaki Lake is large, represented by various species of *Melosira* and *Cyclotella* and, especially, naviculoid forms, which are abundant in colder waters. Northern, Arctic, and alpine species predominate, tropical elements are richly represented. The alpine and Arctic diatoms are the following:

<i>Melosira distans.</i>	<i>Diploneis marginistrata</i>
<i>Melosira rotula</i> var. <i>valida</i> .	<i>Navicula Rolleauxi</i>
<i>Cyclotella glomerata</i> .	<i>Pinnularia leptosema</i>
<i>Diatoma kiemense</i>	<i>Cymbella marginalis</i>
<i>Exocetia praeerupta</i> .	<i>Cymbella aequata</i>
<i>Encyonema flexella</i> .	<i>Cymbella heteropileata</i> var. <i>minor</i>
<i>Achnanthes lunulata</i> var. <i>eliptica</i> .	<i>Cymbella gracilis</i>
<i>Frustulia rhomboides</i> .	<i>Gomphonema quadrupunctatum</i>
<i>Neidium bicarinatum</i> .	<i>Rhopalodiscus parallelus</i>
<i>Neidium Kazlowi</i> .	

It is interesting to note that *Neidium Kazlowi* is reported from central Asia and *Gomphonema quadrupunctatum* from Laikal Lake, northern Europe, and Mongolia.

To tropical elements must be referred the following species:

<i>Melosira americana</i> .	<i>Amphora delphinea</i>
<i>Melosira undulata</i> var. <i>Nor-</i> <i>mansi</i> .	<i>Cymbella turgidata</i>
<i>Actinella brasiliensis</i> .	<i>Cymbella turgida</i>
<i>Exocetia tropica</i> .	<i>Gomphonema gracile</i>
<i>Neidium oblique-striatum</i> var.	<i>Gomphonema Berggrenii</i>
<i>Neidium confereaceae</i> .	<i>Epithemia cistula</i> var. <i>bavarica</i>
	<i>Surirella Terryana</i>

Such diatoms as *Melosira americana*, *Neidium oblique-striatum*, and *Surirella Terryana* occur in South America. A peculiar diatom, *Actinella brasiliensis*, is still living in Nippon, occurs in Demerara River in Guyana, South America, and is known as a fossil in the southern part of France. *Gomphonema Berggrenii* was described from New Zealand; *Epithemia cistula* is living in India and southern China, and is reported as a fossil in Hungary.

The brackish-water species from Kizaki waters are represented by the following:

<i>Fragilaria construens</i> var. <i>sub-</i> <i>zelina</i> .	<i>Navicula protracta</i>
<i>Achnanthes Hawkiensis</i> .	<i>Navicula holoptila</i> forma <i>unior</i>
<i>Rhoosphenia curvata</i> .	<i>Navicula epilimnetica</i> var.
<i>Diploneis Smithii</i> var.	<i>Pinnularia tenuis</i> var. <i>leptogongyia</i>

Large new forms of *Diploneis Smithii* found in Kizaki Lake seem to belong to alpine species. The type of *Diploneis Smithii*

is known from brackish waters. Two fossil diatoms were discovered in Kizaki Lake. These are *Pinnularia Ignitica*, originally reported from Nippon Ignite, and *Cymbella serrata* var. *antiqua* from Hungary.

The endemic diatoms in Kizaki Lake are represented by the following species.

<i>Veratromia arcuata</i> var. <i>Hatto-</i> <i>maura</i> .	<i>Pinnularia matycephala</i> var. <i>Hatto-</i> <i>maura</i> .
<i>Synedra japonica</i>	<i>Pinnularia montana</i> var.
<i>Achnanthus pinnata</i> var. <i>japo-</i> <i>nica</i>	<i>Cymbella japonica</i> .
<i>Navicula subdiscophora</i> .	<i>Compsoneura vastum</i> .
<i>Navicula globuliformis</i>	<i>Compsoneura magnitudinum</i>
<i>Pinnularia divergens</i> var. <i>japo-</i> <i>nica</i> .	<i>Nitzschia interrupta</i> .
<i>Pinnularia Ignitica</i> .	<i>Surirella robusta</i> forma <i>lata</i> .
	<i>Surirella Capronii</i> var. <i>obtusa</i> .
	<i>Surirella Pan'osokii</i> .

All these diatoms were described by Reichenb., Meister, Hustedt, and Cleve. The present list contains the names of 84 new diatoms, and they are also endemic to this country. This note is illustrated with drawings by the author, which will be of use in future investigations.

MELOSTRA VARIANS C. A. Ag. Plate 3, fig. 22.

Melostra varians C. A. Ag., Fl. Hustedt, Bacillar. (1930) 86, fig. 41.

Frustules 0.015 mm in breadth. Not common in Kizaki Lake. Known from Nippon.

MELOSTRA GRANULATA (Ehr.) Ralfs. Plate 1, fig. 6.

Melostra granulata (Ehr.) Ralfs., Fl. Hustedt, Bacillar. (1930) 87, fig. 44.

Frustules 0.01 mm in breadth. Rare Known from Aokiko Lake.

MELOSTRA DISTANS (Ehr.) Kütz. Plate 1, fig. 18.

Melostra distans (Ehr.) Kütz., Fl. Hustedt, Bacillar. (1930) 92-93, fig. 52.

Frustules 0.005 to 0.007 mm in breadth with fine puncta 15 in 0.01 mm. Common in Kizaki and Aokiko Lakes. Known from alpine waters.

MELOSTRA DISTANS (Ehr.) Kütz. var. LIRATA (Ehr.) Benth. Plate 10, fig. 18

Melostra distans (Ehr.) Kütz. var. *lirata* (Ehr.) Benth., Fl. Hustedt, Bacillar. (1930) 93, fig. 55.

A variety with more robust frustules 0.006 to 0.007 mm in breadth. Size 10 to 0.01 mm. Rather common in Kizaki.

Lake. The variety *africana* O. Muell., found by Fr. Hustadt in Aokiko Lake, was not seen in Kizaki Lake.

MELOSIRA AMERICANA Kütz. Plate 1, fig. 1.

Melosira americana KÜTZING, Bacillar (1865) 55, pl. 30, fig. 69 Fr. HUSTADT, Bacillar a. d. Aokikosee in Japan 156, pl. 5, fig. 8.

Frustules cylindrical, barrel-shaped, 0.012 to 0.015 mm. in diameter, with spinous junctions. This species is fairly abundant in Kizaki Lake. *Melosira americana* was described by Kutzung from tropical America in 1865 and found by Fr. Hustadt in Aokiko Lake in Nippon.

MELOSIRA BINDERANA Kütz. Plate 1, figs. 2 and 4; Plate 10, fig. 6.

Melosira Binderana KÜTZ, Fr. HUSTADT, Bacillar. (1930) 26-27 fig. 43

A distinct species with small, slightly siliceous frustules breadth, 0.004 to 0.005 mm. Common in Kizaki Lake. Known from Europe and Asia.

MELOSIRA GRDULATA (Ehr.) KÜTZ. var. *NOBIMANNI* Arnott. Plate 1, fig. 2

Melosira grdulata (Ehr.) KÜTZ var. *Nobimanni* Arnott, VAN HURCK, Synopsis pl. 90, fig. 7.

A very robust species with frustules 0.027 to 0.03 mm. in breadth. This tropical diatom is known from Aokiko Lake in Nippon, southern China, and Java, and is a fossil in Europe.

MELOSIRA ITALICA (Ehr.) KÜTZ. var. *TFENISSIMA* (Grun.) O. Muell. Plate 1, fig. 5.

Melosira italica (Ehr.) KÜTZ var. *tfenissima* (Grun.) O. Muell. VAN HURCK, Synopsis pl. 98, fig. 11.

A delicate form with frustules 0.004 mm. in breadth. Common in Kizaki Lake.

MELOSIRA ITALICA (Ehr.) KÜTZ. var. *VALIDA* Grun. Plate 1, fig. 7.

Melosira italica (Ehr.) KÜTZ, var. *valida* Grun., Fr. HUSTADT, Bacillar (1930) 94, fig. 51.

A distinct form with frustules 0.02 to 0.03 mm. in breadth and 0.027 to 0.03 mm. in length. Puncta 12 in 0.01 mm. Very common in Kizaki and Aokiko Lakes in Nippon. Known from sub-tropical regions.

MELOSIRA ITALICA (Ehr.) KÜTZ subsp. *SUBARCTICA* O. Muell. Plate 1, fig. 6.

Melosira italica (Ehr.) KÜTZ subsp. *subarctica* O. Muell., Fr. HUSTADT Bacillar (1930) 92, fig. 52.

Frustules in long filaments, 0.0076 to 0.008 mm. in breadth. Striae 18 in 0.01 mm. Puncta 24 in 0.01 mm. Known from Nippon.

CYCLOTELLA STELLIGERA Cleve and Grun. Plate 1, fig. 11

Cyclorella stellata Grun. Cleve and Grun., FR. HUSTEDT, Baeckar (1930), 100 (fig. 65).

A distinct species with a ring of alveo. in the center of the valve. Diameter of the valve 0.012 mm. Striae 18 in 0.01 mm. Not common. Known from Aokiko Lake.

CYCLOTELLA GLomerata Bachmann ex. NIPPONICA sp. nov. Plate 1, fig. 12

A little species with a circular valve consisting of a hyaline central area one-half the diameter of the valve, with a rim of transverse striae. Diameter of the valve 0.0036 to 0.004 mm. Striae 18 in 0.01 mm. Differs from the type in a coarser striae. *Cyclorella glomerata* is known from several lakes of Europe.

CYCLOTELLA MENEGHINIANA Kutz. var. NIPPONICA var. nov. Plate 2, fig. 16

This new variety differs from the type by a ring of scattered beads near the marginal rim of the transverse striae. Diameter of the valve, 0.012 mm. Striae robust, 7 in 0.01 mm. Occasional in Kizaki Lake.

CYCLOTELLA COMTA Ehr. figs.

Cyclorella comta (Ehr.) Kutz. VAN HELDER Synopsis pl. 92, figs. 16-23.

Valve circular, consisting of a large central area, one-third the diameter of the valve and a rim one-third the valve diameter, the former with puncta finely distributed over the entire valve in rows radial from the center. Rim ornamented with delicate transverse striae. Diameter of the valve 0.001 to 0.045 mm. Very common in Kizaki Lake. Known from Aokiko Lake.

CYCLOTELLA COMTA Ehr. var. var. PARVATA Grun. Plate 12, fig. 2

Cyclorella comta (Ehr.) Kutz. var. *parvula* Grun. VAN HELDER Synopsis pl. 92, fig. 20.

A variety with a small central area, with scattered beads forming a star in the center. Diameter of the valve, 0.012 mm. Striae 18 in 0.01 mm. Very rare. Known from Aokiko Lake in Nippon.

CYCLOTELLA COMTA Ehr. var. PARVA sp. nov. Plate 8, fig. 13.

Differs from the type in its smaller valve. Diameter of the valve, 0.0042 to 0.006 mm. Common in Kizaki Lake.

STEPHANOPIS ASTRAEA Grun. Grun.

S. phaeocystis Grun. Ehr. Grun. VAN HELDER Synopsis 1, 1880, pl. 95, figs. 5-6.

A common diatom in Kizaki Lake. Known from Aokiko Lake.

TABELLARIA FLUCCULOSA (Ehr.) Kütz. Plate 1, fig. 16.

Tabellaria flacculosa (Roth.) Kütz., Fr. Hustedt, Bacilar 1930 122-124, fig. 101.

Valve linear with median inflation larger than the terminal. Common in Kizaki Lake.

TABELLARIA PENESTRATA (Lyngb.) Kütz. Plate 6, fig. 25.

Tabellaria penestrata (Lyngb.) Kütz., Fr. Hustedt, Bacilar (1930) 122-123, fig. 99.

Valve linear, gibbous in the middle. Ends capitate. Length 0.068 mm; breadth, 0.0045. Striae 18 in 0.01 mm. Uncommon in Kizaki Lake.

DIATOMA VULGARE Bory var. *LINEARIS* Grun. Plate 10, fig. 7.

Diatoma vulgare Bory var. *linearis* Grun., A. Schmidt, Atlas Diatom. pl. 266, figs. 11-17.

Valve linear with slightly truncate end. Length, 0.024 mm, breadth, 0.0034. Striae 15 in 0.01 mm. Not common.

DIATOMA HIEBERGII (Lyngb.) Heiberg. Plate 1, fig. 28; Plate 2, fig. 34. Plate 10, fig. 12.

Diatoma hiebergii (Lyngb.) Heiberg, Fr. Hustedt, Bacilar (1930) 129, fig. 115.

Valve lanceolate, obtuse. Length, 0.02 to 0.03 mm, breadth 0.006 to 0.005. An alpine species.

DIATOMA HIEBERGII (Lyngb.) Heiberg var. *MESODON* (Ehr.) Grun. Plate 12, fig. 13; Plate 3, fig. 10, Plate 10, fig. 25.

Diatoma hiebergii (Lyngb.) Heiberg var. *mesodon* (Ehr.) Grun. Fr. Hustedt, Bacilar (1930) 129, fig. 116.

Valve broad elliptic. Length, 0.012 to 0.017 mm; breadth, 0.007. An alpine diatom reported from Aokiko Lake.

VERDIODON CIRCULARE Agardh. Plate 1, fig. 19.

Veridiodon circulare Agardh, Fr. Hustedt, Bacilar (1930) 126-131, fig. 118.

Valve clavate. Length, 0.032 mm, breadth, 0.0045. Costae 4 in 0.01 mm. Not common. Known from springs and mountain streams.

VERDIODON CIRCULARE Agardh var. *CONSTRICITA* (Ralfs) Van Heurck. Plate 10, fig. 25.

Veridiodon circulare Agardh var. *constricta* (Ralfs) Van Heurck, Fr. Hustedt, Bacilar (1930) 131, fig. 119.

Valve clavate with constricted capitate ends. Length, 0.03 mm; breadth, 0.004. Not common.

OPERPHORA MARTTI Herbold. Plate 2, fig. 27. Plate 13, fig. 3.

Operphora Martti Herbold. Fr. Hustedt, Bacill. (1930) 130, fig. 120.

- Valve broad-ovate, or elongate, rounded at one end and acute at the other. Length, 0.0076 to 0.012 mm, breadth 0.0025 to 0.003. Costae 12 in 0.01 mm. Common in Kizaki Lake. Known from Aokiko Lake.

OPERPHORA MARTTI Herbold var. *ROKUSTA* var. nov. Plate 13, fig. 4. Plate 13, fig. 10.

Valve robust, convex, attenuate towards the ends. Ends broad-obtuse. Length, 0.023 to 0.042 mm; breadth, 0.0068 to 0.009. Costae 5 to 6 in 0.01 mm. Common.

OPERPHORA MARTTI Herbold var. *ELONGATA* var. nov. Plate 13, fig. 15.

Valve long-ovate. One end much broader than the other. Length, 0.015 mm, breadth, 0.005. Costae 9 in 0.01 mm. A distinct variety.

OPERPHORA OKADAE sp. nov. Plate 13, fig. 4.

Valve claviform with subtruncate and usually constricted apex. End attenuate, constricted and capitate. Central area linear. Length, 0.024 to 0.03 mm, breadth, 0.0042 to 0.005. Costae 7 in 0.01 mm. A species distinct from *O. Martti* Herbold. Named in honor of Dr. Yoshikazu Okada, of Tokyo.

CERATONEISS ARCTUS Kutz. var. *HATTORIANA* Meister. Plate 1, fig. 3A.

Ceratoneiss arcta Kutz. var. *Hattoriana* Meister, Beiträge zur Benthos Japan 2 (1914) 226-227 pl. 8, figs. 1-3.

Valve linear with rostrate ends. Length, 0.061 mm, breadth, 0.005. Striae 12 in 0.01 mm. Not common in Kizaki Lake. Reported from Yokohama.

CERATONEISS ARCTUS Kutz. var. *AMPHIOXYLS* (Rupp.) Plate 4, fig. 3A. Plate 11, figs. 13 and 14.

Ceratoneiss arcta Kutz. var. *amphioxys* (Rupp.) Fr. Hustedt, Bacill. (1930) 136, fig. 123.

Valve lanceolate with asymmetrical sides. Length 0.017 to 0.032 mm, breadth 0.0045 to 0.006. Striae 15 to 18 in 0.01 mm. Common in Kizaki Lake.

FRAGILARIA HARRISONII W. Smith. Plate 14, fig. 4.

Fragilaria Harrisonii W. Smith Fr. Hustedt, Bacill. (1930) 130-140, fig. 132.

Valve broad cross-shaped with rounded ends. Length, 0.014 mm; breadth, 0.008. Pseudoraphe narrow. Costae very distinct. A fresh-water atom.

FRAGILARIA HARRISONII W. Smith var. **RHOCHOIDES** Grun. Plate 14, fig. 4.
Fragilaria Harrisonii W. Smith var. *rhochoides* Grun., Fr. Hustert, Bacillar. (1930) 140, fig. 133.

Valve broad-lanceolate. Length, 0.01 mm, breadth, 0.005. Costae robust, 9 in 0.01 mm.

FRAGILARIA HARRISONII W. Smith var. **DUBIA** Grun. Plate 14, fig. 6.
Fragilaria Harrisonii W. Smith var. *dubia* Grun., Fr. Hustert, Bacillar. (1930) 140, fig. 134.

Valve lanceolate with attenuate and capitate ends. Length 0.0187 mm; breadth, 0.005. Costae robust, 9 in 0.01 mm. Not common. Known in European lakes.

FRAGILARIA PINNATA Ehr. Plate 1, fig. 9; Plate 12, fig. 21.
Fragilaria pinnata Ehr., Fr. Hustert, Bacillar. (1930) 142, fig. 141b.

Valve elliptical, with broad ends. Length, 0.0034 to 0.006 mm; breadth, 0.0027 to 0.0034. Costae 12 in 0.01 mm. A freshwater diatom. In Kizaki Lake variety *lanceolata* is reported

FRAGILARIA CROTONEENSIS KITTON. Plate 1, fig. 24.

Fragilaria crotoneensis Kitton, Fr. Hustert, Bacillar. (1930) 137 138, fig. 125.

Valve linear-lanceolate with long-acuminate ends. Length, 0.12 to 0.015 mm; breadth, 0.003. Striae 12 to 13 in 0.01 mm. Common in fresh water. Known from Aokiko Lake

FRAGILARIA GRACILLIMA Mayer. Plate 1, fig. 22.

Fragilaria gracillima Mayer, Fr. Hustert, Bacillar. (1930) 129, fig. 121.

Valve long-lanceolate with capitate and constricted ends. Pseudoraphe very narrow, indistinct. Length 0.018 mm, breadth, 0.002. Striae very fine, 24 in 0.01 mm. This species is reported from Germany only.

FRAGILARIA CAPUCHINA DESM. Plate 1, fig. 21.

Fragilaria capucina Desm., Fr. Hustert, Bacillar. (1930) 138, fig. 126.

Valve sublinear with slightly rostrate and obtuse ends. Length, 0.04 mm; breadth, 0.004. Striae 12 in 0.01 mm. Pseudoraphe very narrow. In the middle part of the valve the striae are interrupted, forming a quadrate central area. A plankton species, known also from Aokiko Lake in Nippon.

FRAGILARIA VIRESCENS Ralfs. Plate 9, fig. 11.

Fragilaria virescens Ralfs., Fr. Hustert, Bacillar. (1930) 142, fig. 144.

Valve lanceolate, rostrate and obtuse. Length, 0.017 mm; breadth, 0.005. Striae 18 in 0.01 mm. Pseudoraphe very

narrow and linear. Very common in Kizaki Lake. Known from many parts of the world.

FRAGILARIA FLEXUOSA (Baltz) var. *ELLIPTICA* Hustich in *NIPPONICA* 10, nov. Plate 12, fig. 26.

Valve lanceolate, dilated, obtuse, not rostrate. Length, 0.009 mm., breadth, 0.003. Striae 18 in 0.01 mm. This form differs from variety *elliptica* in having narrower valves.

FRAGILARIA BREVISTRIGATA Grun. Plate 14, fig. 3.

Fragilaria brevistriata Grun., Pl. HUSTEDT, Bacillar (1930) 146, fig. 151.

Valve lanceolate with acute ends. Length, 0.016 mm.; breadth, 0.0034. Striae 18 in 0.01 mm., marginal. Common.

FRAGILARIA BREVISTRIGATA Grun. var. *INFLATA* (Pust.) Hustich in *CYRTA* 10, nov. Plate 1, fig. 18.

Valve short, lanceolate, with attenuate, obtuse ends. Length 0.0085 mm., breadth, 0.0034. Striae 16 in 0.01 mm. The typical variety *inflata* has a more elongate valve.

FRAGILARIA BREVISTRIGATA Grun. var. *NIPPONICA* var. nov. Plate 15, fig. 7.

Valve lanceolate, biconstricted, with rostrate ends. Length 0.02 mm., breadth, 0.005. Striae 15 to 17 in 0.01 mm. This diatom resembles, under a low power, *Fragilaria Magocsyni* Lacsiny known from Hungary, from which, however, it is different.

FRAGILARIA CONSTRICTA (Ehr.) Grun. Plate 1, figs. 25 and 29.

Fragilaria constricta (Ehr.) Grun., A. SCHMIDT Atlas Diatom. pl. 296, figs. 40-47.

Valve broad-lanceolate with rostrate ends. Length, 0.008 to 0.01 mm.; breadth, 0.004 to 0.006. Striae 15 to 18 in 0.01 mm. This diatom is widely distributed in fresh waters.

FRAGILARIA CONSTRICTA (Ehr.) Grun. var. *SUBSALINA* Hustich. Plate 11, fig. 10.

Fragilaria constricta (Ehr.) Grun. var. *subsalina* HUSTEDT, Bacillar (1930) 141, fig. 139.

Valve linear-lanceolate with obtuse ends. Length, 0.012 mm., breadth, 0.0032. Striae 15 in 0.01 mm. This variety differs from the type in its narrower valves. It is known from brackish waters of Europe.

FRAGILARIA CONSTRIENS Ehr. Grun. var. **TRIUNGULATA** Reichelt. Plate 10, fig. 37

Fragilaria construens Ehr. Grun. var. *triungulata* Reichelt Fr. H. STEIN, Bac. ar. (1930) 140, fig. 136

Valve lanceolate, triradiate with rostrate ends. Length, 0.02 mm breadth 0.006. Striae 18 in 0.01 mm. Pseudoraphe linear. Not common in K. zah Lake

FRAGILARIA CONSTRIENS (Ehr. Grun.) var. **BINODIS** Ehr. Grun. Plate 1, fig. 17. Plate 16, fig. 3

Fragilaria construens Ehr. Grun. var. *binodis* (Ehr. Grun.) Fr. HILSTEDT Bac. ar. (1930) 140-141, fig. 137

Valve biconstricted. Length 0.017 to 0.02 mm. breadth, 0.007 to 0.01. Striae 15 in 0.01 mm. Variety *binodis* is reported from Aokiko Lake.

FRAGILARIA CONSTRIENS (Ehr. Grun.) var. **NIPPONICA** var. nov. Plate 10, fig. 4. Plate 16, fig. 3

Valve minute broad lanceolate with rostrate ends constricted from one or from both sides. Length 0.009 to 0.011 mm, breadth 0.006. Striae 19 in 0.01 mm. This differs from variety *binodis* in its shorter valves.

ASTERIONELLA GRACILLIMA (Hantzsch) Huisberg. Plate 6, figs. 33 and 34

Asteroidea gracilis (Hantzsch) Huisberg Fr. H. STEIN Bac. ar. (1930) 147, fig. 138

Valve linear with capitate ends. Length 0.072 to 0.08 mm, breadth 0.002. Abundant in K. zah Lake.

SYNEDRA NANA Meister var. **NIPPONICA** var. nov. Plate 4, fig. 29

Valve subtriangular, attenuate towards the ends. Length 0.026 to 0.040 mm. breadth 0.0017 to 0.002. Striae marginal very fine, about 30 to 35 in 0.01 mm. Differs from the type in its slightly convex margins.

SYNEDRA UTA Nitzsch Ehr. Plate 6, fig. 36. Plate 3, fig. 9.

Synedra Uta Nitzsch Fr. H. STEIN Bac. ar. (1930) 151, fig. 159

Valve linear lanceolate with rounded ends. Length 0.136 to 0.221 mm. breadth 0.007 to 0.008. Striae 9 to 10 in 0.01 mm. Common in fresh water.

SYNEDRA UTA Nitzsch Ehr. var. **RAMESI** Herib. and Perag. Illustred. Plate 6, fig. 37

Synedra Uta Nitzsch Ehr. var. *Ramesi* Herib. and Perag. Hustedt Fr. H. STEIN Bac. ar. (1930) 152, fig. 160.

Valve linear-lanceolate, little constricted and with truncate ends. Length 0.054 mm. Breadth, 0.006. Striae 11 to 12 in 0.01 mm. Uncommon

SYNEDRA LINNA Nitzeck Ehr. var. *BICAPS* Kütz. Plate 1, fig. 8.

Synedra *Linna* Nitzeck Ehr. var. *biceps* (Kütz.) FR. HUSTEDT Bacter. (1930) 154, fig. 160.

Valve long linear with capitate ends. Length 0.2 to 0.25 mm. Breadth, 0.0045. Striae 8.5 in 0.01 mm. Common in Kizak Lake

SYNEDRA LINNA Nitzeck Ehr. var. *DANICA* Kütz. Grun. Plate 6, fig. 6.

Synedra *Linna* Nitzeck Ehr. var. *danica* Kütz. Grun. FR. HUSTEDT Bacter. (1930) 154, fig. 168.

Valve lanceolate, attenuated towards the ends. Ends slightly subtruncate and constricted. Length, 0.17 mm., breadth, 0.006. Striae 9 in 0.01 mm.

SYNEDRA COTYLINDR (Breb.) Grun. Plate 10, fig. 2.

Spiroa *Georgiana* (Breb.) Grun. & SCHLEIP. Atlas Diatom. pt. 300, figs. 10-18.

Valve deep, constricted with truncate-rostrate ends. Length 0.039 mm., breadth, 0.0165. Striae 15 in 1 mm. Known from Demerara River, Paraguay, and from Victoria Lake, Africa

SYNEDRA BLUMPFNS Kutz. var. *MENEGHINIANA* Grun. Plate 2, fig. 12.

Synedra *blumpfns* Kütz. var. *meneghiniana* Grun. FR. HUSTEDT Bacter. (1930) 56, fig. 178.

Valve lanceolate with truncate ends. Length, 0.03 mm. Breadth, 0.005. Striae 12 in 0.01 mm. Not common

SYNEDRA BLUMPFNS Kutz. var. *NIPPONICA* var. nov. Plate 1, fig. 20.

Valve sub linear, narrowly attenuated towards the ends. Striae very fine. 30 in 0.01 mm., interrupted in the middle part, forming a rectangular area. Length 0.03 mm. Breadth, 0.003. Differs from the type in its fine striae.

SYNEDRA CYCLOPLUM Brzezski var. *NIPPONICA* var. nov. Plate 12, fig. 3.

Valve linear-lanceolate, sigmoid attenuate towards the ends. Length, 0.018 mm. Breadth, 0.002. Striae 18 in 0.01 mm. The typical forms of *Spiroa cyclopium* have the valves larger and they are curved to one side. *Synedra cyclopium* is reported from Europe.

SYNEDRA JAPONICA Meister. Plate 1, fig. 27. Plate 20, fig. 9.

Synedra japonica Meister, Beitrage zur Bacillar Japans (1913) 307, figs. 5-6.

Valve linear-lanceolate with long capitate horns. Length, 0.144 to 0.187 mm, breadth, 0.0028 to 0.003. Striae 11 to 13 in 0.01 mm, interrupted in the middle and forming a quadrate area. Pseudoraphe very narrow. Common in Kizaki Lake. Known from Suwa Lake, Nippon.

SYNEDRA VAUCHERIAE Kütz. Plate 1, fig. 14.

Synedra Vaucheriae Kütz. Fl. Illustrat. Bacillar. (1930) 161, fig. 182.

Valve lanceolate, broad and obtuse. Length, 0.012 mm; breadth, 0.0025. Striae 16 in 0.01 mm. Common in Kizaki Lake.

SYNEDRA VAUCHERIAE Kütz. var. CAPITELLATA Grun. Plate 1, fig. 15; Plate 2, fig. 21.

Synedra Vaucheriae Kütz. var. *capitellata* Grun. Fl. Mustard Bäller. (1900) 101, fig. 104.

Valve lanceolate, attenuate towards the ends. Ends capitate. Length, 0.018 to 0.028 mm; breadth 0.0028 to 0.0042. Striae 12 to 16 in 0.01 mm.

SYNEDRA VAUCHERIAE Kütz. var. SIGMOIDEA var. nov. Plate 1, fig. 16.

Valve lanceolate, sigmoid, with capitate ends, turned opposite. Length, 0.02 mm; breadth, 0.004. Striae fine, 18 in 0.01 mm. Not common in Kizaki Lake.

SYNEDRA PARASITICA (W. Smith) Plate 1, fig. 22.

Fragilaria parasitica W. Smith, A. Schmidl. Atlas Diatom pl. 296, figs. 76-80.

Valve lanceolate, convex, with produced ends. Pseudoraphe w.d. Length 0.012 to 0.02 mm; breadth, 0.004 to 0.006. Striae 18 in 0.01 mm. Meister described *Fragilaria parasitica* var. *asterionelloides* from Nippon, a variety forming asterionelloid colonies.

SYNEDRA NIPPONICA sp. nov. Plate 1, fig. 23.

Valve minute, lanceolate, attenuate towards the ends. Pseudoraphe very narrow. Length 0.01 mm, breadth, 0.002. Striae 18 in 0.01 mm. A species related to *Synedra parasitica*.

ACTINELLA BRASILIENSIS Grun. Plate 8, fig. 11.

Acfeda brasiliensis Grun. A. Schmidl. Atlas Diatom pl. 292, figs. 10-19.

Valve linear inflated at one end, capitate and apiculate. Length, 0.088 mm breadth, 0.013. Striae 10 in 0.01 mm. Not common in Kizaki Lake. Reported from Brazil, Chosen and Hanko Lake in Siberia and as a fossil in southern Europe.

ELNOTIA SEPTENTRIONALIS Ostrop. Plate 2, fig. 23.

Eu-nota a pterostigmatis Ostrop. FR. HUSTEDT Bacillar. (1930) 179, fig. 222.

Valve lanceolate with gibbosus dorsa and parallel ventra sides. Length, 0.0136 mm, breadth, 0.0034. Striae 18 in 0.01 mm. Not common in Kizaki Lake. Reported from Germany as a relict.

ELNOTIA TROPICA Hustedt. Plate 8, figs. 19 and 16.

Eu-nota tropica Hustedt Bacillar. o. d. Aokikosee in Japan 169, p. 5, fig. 1.

Valve robust with four or five undulations on the dorsal side. Length, 0.078 to 0.088 mm, breadth, 0.017. Striae 8 to 9 in 0.01 mm. Uncommon in Kizaki Lake. Known from Aokiko Lake from Foochow, southern China, and, according to FR. Hustedt from the Tropics.

ELNOTIA FABA (Ehr.) Grun. var. **NIPPONICA** var. nov. Plate 16, fig. 4.

Valve linear and obtuse. Length, 0.013 to 0.016 mm, breadth, 0.0028 to 0.003. Striae fine, 18 in 0.01 mm. Typical *Eu-nota faba* has larger valves, and is an alpine plant.

ELNOTIA PALUDOSA Grun. Plate 1, fig. 25.

Eu-nota paludosa Grun., FR. Hustedt Bacillar. (1930) 178, fig. 228.

Valve linear, curved, with rostrate-truncate ends. Length, 0.047 mm, breadth, 0.005. Striae 12 in 0.01 mm. Reported from Europe.

ELNOTIA LUNARIS (Ehr.) Grun. Plate 1, fig. 41.

Eu-nota lunaris (Ehr.) Grun. FR. Hustedt Bacillar. (1930) 183, fig. 249.

Valve linear curved. Length, 0.085 mm, breadth, 0.0025. Striae 18 in 0.01 mm. Uncommon in Kizaki Lake.

ELNOTIA GRACILIS (Ehr.) Rabn. Plate 1, fig. 40.

Eu-nota gracilis (Ehr.) Rabn. FR. Hustedt, Bacillar. (1930) 185, fig. 253.

Valve long, curved, with capitate ends. Length, 0.111 mm, breadth, 0.005. Striae 12 in 0.01 mm. Occasional in Kizaki Lake.

EUNOTIA VALIDA Hustvedt. Plate 11, fig. 41*Eunotia validula* H. STEEDT, Bacol. 1930 178, fig. 229

Valve linear, robust, with obtuse ends. Length, 0.096 mm breadth, 0.0042. Striae 12 to 0.01 mm. Reported from wet rocks from Europe

EUNOTIA VENERIS (Kutz.) O. MÜLL. var. *NIPPONICA* var. nov. Plate 1, fig. 31

Valve lanceolate-attenuate towards the ends. Length, 0.0187 mm, breadth, 0.0034. Striae 15 to 0.01 mm. Differs from the type in having broader ends

EUNOTIA PRÆRUPTA Ehr. Plate 12, fig. 25.*Eunotia prærupta* Ehr., FR. HUSTVEDT, Bacol. 1930 174 fig. 21

Valve robust, curved, with convex dorsal sides. Length, 0.05 mm breadth, 0.01. Striae 12 to 15 to 0.01 mm. An alpine diatom

EUNOTIA PECTINALIS Kütz. Rabb. var. *MINOR* Rabb. Plate 1, fig. 30*Eunotia pectinalis* Kütz. Rabb. var. *minor* (Kütz.) Rabb. FR. HUSTVEDT, Bacol. 1930 182 fig. 258

Valve linear, curvate, slightly attenuate and obtuse. Length, 0.03 mm, breadth, 0.006. Striae 10 to 11 to 0.01 mm. Common in fresh water

EUNOTIA PECTINALIS Kütz. Rabb. var. *MINOR* Rabb. to *IMPRESSA* (Ehr.) Plate 1, fig. 30*Eunotia pectinalis* Kütz. Rabb. var. *minor* Kütz. Rabb. to *impressa* (Ehr.) FR. HUSTVEDT, Bacol. 1930 182 fig. 239

Valve lanceolate, curvate, constricted on the dorsal side. Length, 0.022 mm breadth, 0.004. Striae 15 to 0.01 mm. Common in marsh water

EUNOTIA PECTINALIS Kütz. Rabb. var. *NIPPONICA* var. nov. Plate 1, fig. 32

Valve lanceolate-attenuate towards the ends obtuse. Two interruptions in the middle of the ventral side. Length, 0.019 mm breadth, 0.0048. Striae 15 to 0.01 mm. Differs from the type by its interruptions

COCCONEIS PLACINTULA Ehr. var. *LINEATA* Ehr. Cleve. Plate 2, fig. 5*orobensis* var. *lineata* Ehr. var. *lineata* Ehr. Cleve, FR. HUSTVEDT, Bacol. 1930 170, fig. 262

Valve elliptical with broad ends. Length, 0.022 mm, breadth, 0.012. Striae 18 to 20 to 0.01 mm. Common in fresh water

COCCONEA PLATENTILLA Ehr. var. *KENORAPHIS* Geitler in *NIPPONICA* 6, no. 2
Plate 2, fig. 8

Valve elliptical with a curvate median line. Length, 0.020 mm. breadth, 0.018. Striae 24 to 0.01 mm. Differ from variety *Kenoraphis* in its broad rounded ends.

COCCONEA DISTINCTA Penn. * Plate 2, figs. 16 to 8

* *Cocconeidea distincta* Lautz, Fr. HISTEDT Barilla 1920, 130, fig. 265
Valve broad, elliptical. Length, 0.008 to 0.018 mm. breadth, 0.008 to 0.01. Upper valve with linear axial area. Striae 22 to 0.01 mm. Lower valve with ancolate axial area with coarse elongate puncta. 12 to 0.01 mm. Common. Known from N. America.

ECOCOCCONEA PLENA J.A. Schatz. Plate 2, fig. 39

Eucocconeidea plena Kutz. Fr. HISTEDT Bacilar 1920, 103, fig. 270.

Valve elliptical with an arcuate median line. Length 0.035 mm. breadth, 0.015. Common in a pure waters.

ACHMANTHES MICROCEPHALA Kutz. Plate 2, fig. 32

Achmanthes microcephala Kutz. Fr. HISTEDT Barilla 1920, 138, fig. 273.

Valve linear with subcapitate ends. Length 0.018 mm. breadth, 0.002. Striae not steeper. Known from fresh water in Europe.

ACHMANTHES KIZANT sp. nov. Plate 2, fig. 70

Valve rear enlarged in the middle with broad, capitate ends. Length 0.013 mm. breadth 0.002. Upper valve with a narrow rear axial area and a narrow rectangular central area. Lower valve with slightly elevated central area. Striae very fine about 40 to 0.01 mm. A species related to *A. microcephala* Kutz.

ACHMANTHES BAUCKEANA Grun. Plate 2, fig. 26

Achmanthes Bauckeana Grun., Fr. HISTEDT Bacilar 1920, 202, fig. 290.

Valve elliptical obtuse. Length, 0.015 mm. breadth, 0.005. Upper valve with a linear axial area. Striae 14 to 0.01 mm. Lower valve with a broad central area. Striae radiate. Known from hot springs and brackish water.

ACHMANTHES HATCIANA Grun. var. *ELLIPTICA* Schmid. & *NIPPONICA* sp. nov.
Plate 14, fig. 6.

Valve elliptica. Length, 0.01 mm., breadth, 0.042. Upper valve with linear axial area. Striae 18 in 0.01 mm., radiate. Lower valve with a broad central area. Differs from variety *elliptica* in its coarser striae.

ACHMANTHES DESTRIPIA (A. Cava) Hustedt. Plate 2, figs. 21 and 22; Plate 13, fig. 17.

Achnanthes Oestrupi (A. Cava) Hustedt, Bacillar. (1930) 257, fig. 301.

Valve broad-elliptica. Length, 0.09 to 0.015 mm.; breadth, 0.007 to 0.0086. Upper valve with a linear axial area, on one side of which in the middle of the valve there is a horseshoe-shaped area. Striae robust, radiate, 12 to 18 in 0.01 mm. Lower valve with a narrow stauros. Striae very fine, about 35 in 0.01 mm. Known from Europe.

ACHMANTHES CLEVEI Grun. var. *NIPPONICA* A. var. nov. Plate 2, fig. 23.

Valve lanceolate, convex, acute obtuse. Length, 0.014 mm., breadth, 0.005. Upper valve with narrow, linear, axial area. Striae distinctly punctate, 12 in 0.01 mm., radiate. Puncta 15 in 0.01 mm. Lower valve with narrow central area. Striae very fine, 20 to 22 in 0.01 mm. Differs from the type in its obtuse ends and differs from variety *rostrata* Hustedt in its broad end. *Achnanthes Clevei* is known from Europe.

ACHMANTHES EXIGUA Grun. Plate 2, fig. 16.

Achnanthes exigua Grun., Fr. Hustedt, Bacillar. (1930) 201-202, fig. 286.

Valve elliptic with rostrate ends. Length, 0.015 mm.; breadth, 0.006. Striae 24 in 0.01 mm. Known from fresh water and hot springs. Reported from Aokiko Lake.

ACHMANTHES EXIGUA Grun. var. *INDICA* Skvortzow. Plate 2, fig. 24.

Achnanthes exigua Grun. var. *indica* Skvortzow, Diatoms from Calcutta (1925) p. 1, fig. 3.

Valve minute, broad-ovate. Length, 0.0068 mm.; breadth, 0.0042. Upper valve with narrow axial area. Striae parallel, 18 to 20 in 0.01 mm. Lower valve with narrow axial area, and with central area forming a short stauros with one median shortened stria opposite the stauros. Recently described by me from Calcutta, India.

ACHMANTHES EXIGUA Grun. var. *NIPPONICA* var. nov. Plate 2, figs. 7 and 8.

Valve elliptical with rostrate ends. Length, 0.012 mm.; breadth, 0.0062. Upper valve with a narrow axial area. Striae

18 in 0.01 mm parallel, at the ends slightly radiate. Lower valve with a median stria, opposite to the fascia being shortened. The type of *Achnanthes elongata* Grun. differs from variety *imponata* in its bilateral broad fascia.

ACHNANTHES PERAGALLII Grun. and Heimbold. Plate 2, fig. 30.

Achnanthes Peragalli Bréb. and Heimbold. Diatom d'Auvergne (1893) 50, pl. 1, fig. 4.

Valve broadly elliptical with apiculate ends. Length, 0.012 mm, breadth, 0.006. Upper valve with lanceolate axial area on one side of which there is a horseshoe area. Striae 18 in 0.01 mm. Lower valve with dilated central area. Known from Aokiko Lake.

ACHNANTHES PERAGALLII Grun. and Heimbold var. **NIPPONICA** var. nov. Plate 2, fig. 30.

Valve lanceolate convex, with long attenuate ends. Length 0.025 mm, breadth, 0.0085. Upper valve with a broad, axial area. Central area of the lower valve with a broad staurus. Differs from the type in its more elongate shape. Common in Kizaki Lake.

ACHNANTHES GRACILLIMA Hostert var. **NIPPONICA** var. nov. Plate 4, figs. 3 and 4.

Valve slightly siliceous, narrow lanceolate with acute and capitate ends. Length, 0.015 to 0.018 mm, breadth, 0.0034 to 0.0036. Upper valve with distinct axial area. Lower valve with a narrow axial area outwardly dilated. Striae very fine and distinct. Common in Kizaki Lake. The type is reported from Aokiko Lake.

ACHNANTHES AFFINIS Grun. var. **MINUTA** var. nov. Plate 10, fig. 27.

Valve linear lanceolate with obtuse ends. Length, 0.0085 mm, breadth 0.0017. Upper valve with a narrow axial area. Striae radiate very fine, in the middle 30, at the ends 40, in 0.01 mm. Lower valve with a dilated central area. The type of *Achnanthes affinis* occurs in fresh waters of Europe, Tasmania, and North America.

ACHNANTHES MINIMA Kutz. Plate 2, figs. 1 and 2.

Achnanthes minima Kutz. FR. L'ESTRÉG. Bact. (1930, 195, fig. 274).

Valve linear with attenuate and obtuse ends. Length 0.013 to 0.022 mm, breadth 0.002 to 0.005. Striae 28 in 0.01 mm or very fine and indistinct. Not common.

ACERANTHES MINUTISSIMA Kütz. var. CRYPTOCEPHALA Grun. Plate 2, fig. 1.

Aceranthes minutissima Kütz. var. *cryptocephala* Grun. Fl. Hustedt, Bacillat. (1930) 196, fig. 275.

Valve linear with capitate ends. Length, 0.015 mm., breadth, 0.002. Striae 30 in 0.01 mm. Uncommon.

ACERANTHES LINEARIS W. Smith var. PUSILLA Grun. Plate 10, fig. 17.

Aceranthes linearis W. Smith var. *pusilla* Grun. Fl. Hustedt Bacillat. (1930) 196, fig. 277.

Valve elongate-linear with obtuse ends. Length, 0.012 mm., breadth, 0.002. Striae widened in the middle part of the valve, 24 in 0.01 mm. Known from Greenland and Norway.

ACERANTHES LANCEOLATA Breb. Plate 2, figs. 11 and 12.

Aceranthes lanceolata Breb., Fl. Hustedt, Bacillat. (1930) 207, fig. 306a.

Valve elliptic-lanceolate, ends obtuse. Length, 0.0136 mm., breadth, 0.005. Upper valve with lanceolate axial area and with a horseshoe area on one of the sides. Lower valve with a quadrate or rectangular central area. Striae 15 in 0.01 mm. Common in fresh water. Known from Aotuk Lake.

ACERANTHES LANCEOLATA Breb. var. ELLIPTICA Cleve. Plate 2, fig. 13.

Aceranthes lanceolata Breb. var. *elliptica* Cleve, Fl. J. Sturt Bacillat. (1930) 208, fig. 306c.

Valve elliptic, obtuse. Length, 0.015 mm.; breadth, 0.0085. Striae 18 in 0.01 mm. An alpine species, reported from Europe.

ACERANTHES LANCEOLATA Breb. var. ROSTRATA Hustedt. Plate 2, fig. 20. Plate 1, fig. 8. Plate 10, fig. 15.

Aceranthes lanceolata Breb. var. *rostrata* Hustedt, Bacillat. (1930) 207-208, fig. 306b.

Valve elliptical with rostrate ends. Length, 0.012 to 0.018 mm., breadth, 0.005 to 0.0068. Upper valve with a lanceolate axial area and on one side with a horseshoe area. Striae robust, 12 to 18 in 0.01 mm.

ACERANTHES LANCEOLATA Breb. var. NIPPONICA var. nov. Plate 12, fig. 13.

Valve broad-lanceolate, slightly gibbous in the middle narrowed towards the ends. Length, 0.016 mm.; breadth, 0.006. Upper valve with a lanceolate axial area and with a horseshoe area on one side. Lower valve with a rectangular contra area. Striae 12 in 0.01 mm. Not common.

ACERANTHES PINKELIA Hustedt var. JAPONICA Hustedt. Plate 2, fig. 25. Plate 4, fig. 26.

Aceranthes pinkeli Hustedt var. *japonica* Hustedt, Bacillat. a. d. Aotukossee in Japan 161, pl. 5, figs. 12-16.

Valve minute, elliptic and obtuse. Length, 0.0051 to 0.006 mm, breadth, 0.0034. Upper valve with very narrow axial area. Striae 18 in 0.01 mm. Lower valve with indistinct axial area and with a small central area. Reported only from Aokiko Lake, Nippon.

GENUS OSPRENIA Grun.

Phaeosphaeria curvata (Kütz.) Grun. Fr. Hustedt, Bacillar. (1930) 311, fig. 311.

Valve excavate. Length, 0.019 mm; breadth, 0.0023. Common in fresh and brackish water.

AMPHIPLEXA PERLUCIDA Kutz. Plate 3, fig. 3.

Amphiplexa pallens Kutz. Fr. Hustedt, Bacillar. (1930) 218 fig. 321.

Valve lanceolate-attenuate. Length, 0.085 mm; breadth, 0.007. Striae very fine. Found in fresh and slightly brackish water. Known from Nippon.

AMPHIPLEXA PERLUCIDA Kutz. var. RECETA Kütz. Plate 3, fig. 4.

Amphiplexa pallens Kütz. var. *recta* Kütz., Journ. Quillett Mic. Soc. 2: 21, pl. 4, fig. 4.

Valve linear with gently concate ends. Length, 0.2 mm breadth, 0.015. Striae 30 in 0.01 mm. According to Kütz variety *recta* is a marine diatom found in Nippon. Reported by me from a mountain stream in southern China (Fnoochow, Fukien Province).

PRISTULIA VULGARIS Thunb. Plate 4, fig. 11.

Prasinula vulgaris Thunb. Fr. Hustedt, Bacillar. (1930) 221, fig. 327.

Valve linear and obtuse. Length, 0.044 mm; breadth, 0.0085. Striae very fine. Not common. Reported from Nippon.

PRISTULIA RHOMBOIDES (Ehr.) de Toni. Plate 4, fig. 12.

Prasinula rhomboidea (Ehr.) de Toni. Fr. Hustedt, Bacillar. (1930) 220, fig. 323.

Valve rhombic-lanceolate, attenuate with obtuse ends. Length, 0.17 mm; breadth, 0.03. Central nodule small or elongate. Striae 24 in 0.01 mm. Common in fresh water.

PRISTULIA RHOMBOIDES (Ehr.) de Toni var. AMPHIPLEUROIDES Grun. Plate 4, fig. 13.

Prasinula rhomboidea (Ehr.) de Toni var. *amphiplectoides* Grun. Fr. Hustedt, Bacillar. (1930) 221, fig. 326.

Valve lanceolate, obtuse. Length, 0.127 mm; breadth, 0.018. Striae 24 in 0.01 mm. Reported from Aokiko Lake, Nippon.

FRUSTULIA RHOMBOIDES Ehr. de Toni var. **SAXONICA** Rabh. de Toni in CA
PITATA A Mayer Plate 4 fig. 12

Frustula rhomboides Ehr. de Toni var. *saxonica* Rabh. de Toni
in *capitata* A. Mayer, Fr. Hustedt Bacillar (1930) 221

Valve lanceolate with capitate ends Length 0.044 mm
breadth, 0.013 Uncommon

FRUSTULIA RHOMBOIDES (Ehr. de Toni var. **SAXONICA** Rabh.) de Toni in CA
PITATA Hustedt

Frustula rhomboides (Ehr. de Toni var. *saxonica* (Rabh.) de Toni
in *capitata* Hustedt, Bacillar (1930) 221

Valve slightly trapezoid with capitate ends Length 0.056
mm breadth, 0.012 Rare in Kizaki Lake

GYROSIGMA ACUMINATUM Kutz. Rabh. Plate 5 fig. 14

Gyrosigma acuminatum Kutz. Rabh. Fr. Hustedt Bacillar (1930)
222-223, fig. 309.

Valve with longitudinal and transverse striae, 18 in 0.01 mm
Length, 0.136 mm breadth, 0.02 Common

GYROSIGMA BULZINGII (Grun. Cleve) Plate 5 fig. 7

*Gyrosigma K. bulz. (Grun. Cleve) Fr. Hustedt Bacillar (1930)
224 fig. 333*

Valve sigmoid and attenuate Length, 0.098 mm, breadth,
0.012. Striae, transversal 18, longitudinal 30, in 0.01 mm. A
fresh-water species. Known from Nippon

GYROSIGMA SCALPOIDES Rabh. Cleve Plate 4, fig. 6.

Gyrosigma scalpoides (Rabh. Cleve) Fr. Hustedt Bacillar (1930)
226, fig. 338

Valve sigmoid with broad ends Striae, longitudinal 30,
transversal 24, in 0.01 mm Length 0.064 mm breadth, 0.008
Known from Europe, America and Africa.

CALONEIS STICKELA Ehr. Cleve var. **TRUNCATULA** Hustedt in **NIPPONICA** sp. nov. Plate
5, fig. 2

Valve triundulate with broad ends Length, 0.102 mm,
breadth 0.015 Striae radiate 18 in 0.01 mm Differs from the
type in its broad and long ends.

CALONEIS STICKELA (Ehr.) Cleve var. **TRUNCATULA** Grun. Plate 4 fig. 17

Caloneis stickelia (Ehr.) Cleve var. *truncatula* Grun. Fr. Hustedt,
Bacillar (1930) 238, fig. 363

Valve slightly undulate in the middle part Central area a
broad fascia Length, 0.022 mm, breadth, 0.0058. Striae 24
in 0.01 mm Common in fresh water

CALOYEIS SILICULA (Ehr.) Cleve var. *BAIKALENSIS* Shvorzow and Meyer. Plate 4, fig. 6.

Ceratoneis silicula (Ehr.) Cleve var. *baikensis* Shvorzow and Meyer,
Contribut. diatoms of Baikal Lake (1928) 12, pl. 1, fig. 44.

Valve linear, triundulate with broad capitate ends. Striae 24 in 0.01 mm. Central area with a broad stauros. Length, 0.061 mm; breadth, 0.011. Reported from Baikal Lake, Siberia.

NEODILIM HITCHCOCKII (Ehr.) Plate 4, fig. 1.

Nodularia Hitchcockii Ehr., A. Scien., Atlas Diatom. pl. 49, figs. 35-36.

Valve elliptic, triundulate with rostrate ends. Length, 0.057 mm; breadth, 0.013. Striae 18 in 0.01 mm. Common in fresh water.

NEODILIM PROTRUDENS (W. Smith) Cleve fa. *CONSTRUCTA* Hustedt. Plate 4, fig. 2.

Nodularia protrudens (W. Smith) Cleve fa. *constructa* Hustedt, Baillier (1930) 246.

Valve constricted with apiculate ends. Length, 0.049 mm, breadth 0.011. Striae 24 in 0.01 mm.

NEODILIM AFFINE (Ehr.) Cleve fa. *HERCYNICA* (A. Meyer) Hustedt. Plate 4, fig. 4.

Nodularia affine (Ehr.) Cleve fa. *hercynica* (A. Meyer) Hustedt
Bac. lxx. (1930) 243.

Nodularia affine var. *genuine* CLEVE, Bacillar. d. Regensburger Ge-
wasser (1913) 109, pl. 10, fig. 32.

Valve lanceolate with obtuse ends. Length, 0.037 mm, breadth, 0.01. Striae 20 to 24 in 0.01 mm. Known from Europe.

NEODILIM BISULCATUS (Lange) Cleve var. *KIPPONICA* var. nov. Plate 5, fig. 1
Plate 4, fig. 5.

Valve linear-lanceolate with slightly attenuate ends. Length, 0.034 to 0.06 mm; breadth, 0.006 to 0.01. Striae 20 to 30 in 0.01 mm. Differs from the type in its attenuate and acute ends. The type is common in alpine regions.

NEODILIM DUBIOX (Ehr.) Cleve. Plate 5, fig. 10.

Nodularia dubiosa (Ehr.) Cleve, Pl. Hustedt, Baillier. (1930) 246,
fig. 385.

Valve broad-lanceolate with acuminate ends. Length, 0.034 mm, breadth, 0.01. Striae 18 in 0.01 mm. Common in fresh and brackish waters.

NEODILIM KIPPONICA sp. nov. Plate 5, fig. 1.

Valve large, lanceolate with obtuse ends. Striae oblique, 18 in 0.01 mm, crossed by longitudinal marginal band. Axial area

narrow, widened on the middle part of each end. Central area broad. Length, 0.142 mm., breadth, 0.025. A distinct species, it resembles *Narietia* sp. figured in A. Schmidt, Atlas Diatom pl. 49, fig 1 from Monticello, New York.

NEIDIUM KOZLOWI Merech. var. **NIPPONICA** var. nov. Plate 4, fig. 19.

Valve linear with parallel margins and rostrate ends. Striae oblique, 24 to 28 in 0.01 mm. Axial area narrow. Central area broad. Length, 0.34 mm. breadth 0.0062. Differs from variety *parva* Merech. and variety *hankensis* Siv. in its rostrate ends and its size.

NEIDIUM OBLIQUE-STRATUM A. S. var. **NIPPONICA** var. nov. Plate 4, figs. 5 and 2.

Valve lanceolate with attenuate ends. Striae oblique, 16 to 17 in 0.01 mm. Length, 0.096 to 0.1 mm., breadth, 0.02 to 0.025. This new variety resembles *Nerium* sp. in A. Schmidt, Atlas Diatom pl. 49, fig. 1, and *Nerium affine* var. *amphioxanthus* Ehr. fo. *maxima* Cleve, Navicul. Diatom. 69.

NEIDIUM OBLIQUE-STRATUM A. S. var. **ROSTRATA** var. nov. Plate 4, fig. 24.

Valve with rostrate ends. Striae oblique, 24 in 0.01 mm. Length, 0.061 mm. breadth 0.015. Differs from the type in its rostrate ends.

NEIDIUM OBLIQUE-STRATUM A. S. var. **APICULATA** var. nov. Plate 4, fig. 25.

Valve lanceolate with obtuse and apiculate ends. Length, 0.044 mm. breadth 0.012. Striae oblique, 14 in 0.01 mm. Not common.

DIPLONEIS OVALIS (Huse) Cleve. Plate 2, fig. 27.

Diploneis ovalis (Huse) Cleve Fr. Hustedt, Bac Lar. 1930, 249 fig. 390.

Valve elliptic with broad and rounded ends. Length, 0.028 to 0.03 mm. breadth, 0.013 to 0.015. Central nodule large rounded. Transverse rows of alveoli, 10 in 0.01 mm. radiate at ends. Puncta 14 in 0.01 mm. Common in fresh water. Reported from Nippon. According to Fr. Hustedt the Nippon forms of *Diploneis ovalis* are always large with double rows of alveoli. Such forms I find it desirable to separate.

DIPLONEIS OVALIS (Huse) Cleve var. **OBlongella** (Naegele) Cleve. Plate 2, fig. 26.

Diploneis ovalis (Huse) Cleve var. *oblongata* (Naegele) Cleve. Fr. Hustedt Bac Lar. 1930, 249 fig. 391.

Valve near-elliptic. Length, 0.041 to 0.046 mm. breadth, 0.013 to 0.017. Rows of alveoli, 10 to 11 in 0.01 mm. Very common in Kizak. Lake Known from Aokiko Lake.

DIPLOPSIS PELLIC (Schum.) Cleve. Plate 2, fig. 2.

Valve elliptic. Length, 0.023 mm; breadth, 0.012. Central nodule quadrate. Furrows narrow. Costae 12 to 13 in 0.01 mm. Alveoli indistinct. Known from fresh and brackish waters.

DIPLOPSIS MARCINESTRIATA Hustedt. Plate 2, fig. 3.

Diploneis marginestrata Hustedt, Bacillar. (1930) 250, fig. 386.

Valve elongate-elliptic with broad ends. Length, 0.032 mm, breadth, 0.01. Central nodule quadrate. Furrow broad, linear. Costae 21 in 0.01 mm, radiate at the ends. Known from alpine lakes in Europe. Reported from Aokiko Lake, Nippon.

DIPLOPSIS SMITHII (Breb.) Cleve var. NIPPOSTICA var. nov. Plate 2, figs. 1 and 2.

Valve elliptic. Length, 0.068 to 0.1 mm; breadth, 0.03 to 0.047. Central nodule quadrate. Terminal nodules distant from the ends. Furrows broad, inclosing a space one-fourth as broad as the valve. Costae 5 to 6 in 0.01 mm, with double rows of alveoli, forming oblique lines. Differs from the type by its more elongate and attenuate ends. Very common in Kizaki Lake. The typical *Diploneis Smithii* is known as a brackish-water species.

DIPLOPSIS SMITHII (Breb.) Cleve var. OBLONGCELEA var. nov. Plate 3, fig. 1.

Valve elongate-elliptic with broad ends. Length, 0.098 to 0.1 mm, breadth, 0.035 to 0.039. Central nodule quadrate. Furrow broad-lanceolate, inclosing a space one-third as broad as the valve. Costae 6 in 0.01 mm, with a double row of alveoli. Common in Kizaki Lake.

DIPLOPSIS OCULATA (Breb.) Cleve. Plate 2, fig. 4.

Diploneis oculata (Breb.) Cleve, Pl. Hustedt, Bacillar. (1930) 250, fig. 392.

Valve elongate-elliptic. Length, 0.024 mm; breadth, 0.0076. Central nodule quadrate. Furrows linear. Costae 24 in 0.01 mm. Reported from Aokiko Lake.

DIPLOPSIS OCULATA (Breb.) Cleve var. NIPPOSTICA var. nov. Plate 3, fig. 2.

Valve minute, elliptic with attenuated and rounded ends. Striae fine, marginal, 18 in 0.01 mm. Length, 0.012 mm, breadth 0.006. Lateral area hyaline. Central nodule quadrate. Furrow linear, interrupted in the middle part. *Diploneis oculata* is reported from Aokiko Lake.

DIPLONEIS ELLIPTICA (Kutz.) Cleve var. *LADOGENSIS* Cleve. Plate 2, figs. 2 and 6.
Diploneis elliptica (Kutz.) Cleve var. *ladoensis* CLEVE, Thal. Fenn. Land (1893) 43, p. 2 fig. 9

Valve elliptic. Length, 0.027 to 0.035 mm. breadth, 0.015 to 0.023. Transverse costae irregularly anastomosing with a few longitudinal, undulating costae. Known from Europe

STAURONEIS PHENICENTERON Ehr. Plate 6, fig. 12.

Stauroneis phenicenteron Ehr. Fr. Hustedt, Bacil. (1930) 255, fig. 404.

Valve lanceolate with attenuate ends. Length 0.15 mm., breadth, 0.028. Striae 14 in 0.01 mm. Common in fresh water

STAURONEIS PHENICENTERON Ehr. fo. *NIPPONICA* to. nov. Plate 3, fig. 11. Plate 3, fig. 6.

Valve lanceolate broad with acute ends. Striae radiale and commissural curved 14 to 18 in 0.01 mm. Length, 0.085 to 0.11 mm., breadth, 0.024 to 0.025. Differs from the type in its short valve.

STAURONEIS ANCEPS Ehr. Plate 5, fig. 12.

Stauroneis aniceps Ehr. Fr. Hustedt, Bacil. (1930) 256, fig. 405.

Valve lanceolate with attenuate ends. Striae 18 in 0.01 mm. Length, 0.049 to 0.082 mm., breadth, 0.011 to 0.02. Common in fresh water

STAURONEIS ANCEPS Ehr. fo. *GRACILIS* Ehr. Cleve. Plate 5, fig. 24.

Stauroneis aniceps Ehr. fo. *gracilis* (Ehr.) Cleve. Fr. Hustedt Bacil. (1930) 256, fig. 406.

Valve with long capitate ends. Length, 0.08 mm., breadth 0.013. Striae 19 in 0.01 mm. Rare

STAURONEIS ANCEPS Ehr. var. *LINEARIS* Ehr. Cleve. Plate 5, fig. 14.

Stauroneis aniceps Ehr. var. *linearis* (Ehr.) Cleve. Fr. Hustedt Bacil. (1930) 256, fig. 407.

Valve linear with rostrate ends. Length 0.015 mm., breadth, 0.0085. Striae 24 in 0.01 mm. Uncommon

STAURONEIS SMITHII Grun. Plate 3, fig. 1.

Stauroneis Smithii Grun. Fr. Hustedt, Bacil. (1930) 261 fig. 420.

Valve lanceolate, constricted in the middle part rostrate at the ends. Central area a short fascia. Length, 0.016 mm., breadth 0.0042. Common in fresh water

STAURONEIS SMITHII Grun. var. *INCISA* Pantoresek. Plate 3, fig. 27.

Stauroneis Smithii Grun. var. *recta* Pantoresek. Fr. Hustedt Bacil. (1930) 261 fig. 421.

Valve lanceolate, often acute with long cilia. Length, 0.1 mm, breadth, 0.008. Striae 25 in 0.01 mm. Rare.

STRIOMONIA SMITHII Grun. var. *NIPPONICA* var. nov. Plate 4, fig. 7.

Valve slightly trapezoid. Fuds long, acute, acute. Length, 0.034 mm, breadth, 0.0068. Striae 28 to 30 in 0.01 mm. Differs from variety in the in its undulate margins.

ANOMOCHELUS BS L. Kutz. Cleve var. *NIPPONICA* var. nov. Plate 4, fig. 8.

Valve sub-near-lanceolate, asymmetrical, convex, with attenuated, obtuse ends. Length, 0.044 mm; breadth, 0.0051. Striae indistinctly punctate, striolate 18 to 20 in 0.01 mm. Not common in Kizak, Lake.

NAVICULA COSPICATA Kutz. Plate 4, fig. 10.

Navicula cospicata Kutz., Fl. Muskat., Enc. Mar. (1830) 263, fig. 436.

Valve lanceolate, acute. Striae parallel, 15 in 0.01 mm. Length, 0.096 mm, breadth, 0.022. Uncommon.

NAVICULA POLYPSILA (Grum.) Cleve in *MINOR* Kutz. Plate 4, fig. 11.

Navicula polypilla (Grum.) Cleve in *MINOR* Kutz. Kreisgraben des Sperrenberger Salzgebietes, 1927, 47, pl. 1, fig. 4.

Valve lanceolate, acute. Striae fine, slightly radiate; transversal striae 18, longitudinal 30 in 0.01 mm. Axial area narrow. Length, 0.062 mm; breadth, 0.017. Known from brackish water in Europe.

NAVICULA LAPIDOSA Grun. var. *NIPPONICA* var. nov. Plate 4, fig. 12.

Valve elliptica. Striae radiate, 18 to 19 in 0.01 mm. Central area a broad stauros, w-decud and truncate outwards. Axial area very narrow. Length, 0.015 mm; breadth, 0.0085. *Navicula lapidosa* is known from Europe.

NAVICULA ROTUNDATA Rabb. Grun. Plate 4, fig. 13.

Navicula rotundata (Rabb.) Grun. Fl. Muskat., Enc. Mar. (1830) 271, fig. 440.

Valve elliptic, rounded. Striae fine, 20 to 25 in 0.01 mm. Central area a broad stauros. Length, 0.015 mm, breadth, 0.0088. An alpine species.

NAVICULA MUTICA Kutz. Plate 4, fig. 14.

Navicula mutica Kutz., Fl. Muskat., Enc. Mar. 1830, 274, fig. 433.

Valve elliptic-lanceolate. Striae distinctly punctate, 20 in 0.01 mm. Central area with an isolated punctum. Length, 0.022 mm; breadth, 0.0085. Common in fresh water.

NAVICULA PERTUSILLA Grun. Plate 3, fig. 6.

Navicula purpurella Grun., FR H STEED Bacol. 1930: 278, fig. 459.

Valve linear elliptic. Striae very fine 50 in 0.01 mm. Axial area broad. Length, 0.01 mm. breadth, 0.0042. Uncommon in Kizaki Lake.

NAVICULA CONFERVACEA Rutz. & NIPONICA Do. nov. Plate 3, fig. 7. Plate 4, fig. 28.

Valve elliptic, attenuate at the ends. Striae rare, marginal, 15 to 16 in 0.01 mm. Axial and central areas broad-lanccolate. Length, 0.011 to 0.015 mm., breadth, 0.0068 to 0.007. *Navicula confervacea* is common in the Tropics.

NAVICULA AMERICANA Ehr. Plate 2, fig. 23.

Navicula americana Ehr., FR H STEED Bacol. 1930: 280, fig. 464.

Valve linear at base. Length, 0.088 mm., breadth, 0.02. Striae 15 in 0.01 mm. Not common in Kizaki Lake.

NAVICULA LAMBDA Clev. var. DENSISTRIATA var. nov. Plate 4, fig. 5.

Valve linear. Striae in the middle part of the valve 24, in the ends about 30, in 0.01 mm. Length, 0.14 mm., breadth, 0.0085. The Nippon variety differs from the type in its close striae. *Navicula Lambda* is known from Demerara River, South America.

NAVICULA PIP-PIA Kutz. Plate 12, fig. 15.

Navicula purpurea Kutz. var. *rectangularis* (Grun.) Grun. FR HUSTEDT Bacol. 1930: 28 fig. 467b.

Valve linear. Length, 0.039 mm., breadth, 0.008. Striae 24 in 0.01 mm. Common.

NAVICULA PIP-PIA Kutz. var. CAPITATA Benth. Plate 4, fig. 10.

Navicula purpurea Kutz. var. *capitata* HUSTEDT Bacol. 1930: 281 fig. 467c.

Valve with capitate ends. Striae 4 to 20 in 0.01 mm. Length 0.013 to 0.28 mm. breadth, 0.001 to 0.006. Not common.

NAVICULA CHOCOTIA W. Smith. Benth. var. SEITATA var. nov. Plate 5, fig.

Valve elliptic with capitate ends. Striae closer towards the ends, 15 to 16 in 0.01 mm. Axial area very narrow, somewhat widened in the middle part. Length 0.02 mm. breadth 0.006. Differs from the type in its capitate ends.

NAVICULA AQELENTICHA Krasske & MIN'S Krasske. Plate 5, fig. 16.

Navicula aquaelectica Krasske & MIN'S Krasske. Bacol. Veget. Niederhessens (1925) 44 p. 2, fig. 23.

Valve slightly sinuous, linear-constricted in the middle part, alternate armolate at the ends. Length, 0.014 mm. breadth 0.028. Reported from Europe.

NAVICULA MURALIS Grun. Plate 6, fig. 11

see also matsumi Grun. FR. Hustedt Bac far (1930) 288, fig. 38.

A minute elliptical valve with rounded ends. Striae in the middle 28 to 30 at the ends 40, in 0.01 mm. Common in fresh water.

NAVICULA ATOMARIS sp. nov. Plate 2, fig. 3.

Valve linear, slightly convex and oblique. Length, 0.009 mm. breadth 0.014. Striae very fine about 10, in 0.01 mm. Central area round, axial area near and narrow. differs from *N. velata pellucens* Grun. in size and enlarged central area.

NAVICULA ATOMA (Gmelin) Grun. var. *NIPPONICA* sp. nov. Plate 6, fig. 16

Valve elliptical. Striae about 30 in the middle 16, at the ends 24 to 30. Length 0.05 mm. breadth 0.005. *Navicula atomaris* is smaller than the Nippon variety.

NAVICULA MIXTA (Gmelin) Grun. Plate 11, fig. 6

Navicula mixta Grun., FR. Hustedt Bac far (1930) 288, fig. 48.

Valve slightly siliceous, aereolate. Length, 0.01 mm., breadth 0.003. Common.

NAVICULA PUSCA (Eck.) Plate 4, figs. 20 and 21. Plate 21, fig. 2.

Navicula Pusca (Eck.) Synops. of the No. 1 Diatoms 1890, 2, pt. 2, fig. 6.

Valve elliptical with broad radiate striae. Axial area very narrow, central area small. Striae fine, radiate about 25 to 30 in 0.01 mm. closer toward the ends. Length, 0.014 to 0.18 mm. breadth 0.006 to 0.008. Reported from Rotorua Lake, New Zealand and from Aokiko Lake Nippon.

NAVICULA PUSCA (Eck.) *ARCTICA* Pantocsek Stevenson. Plate 2, fig. 35

Navicula pusca (Eck.) Pantocsek Stevenson. Bac far (1909) 3, pl. 6, fig. 97.

Valve larger than the type. Striae very fine. Axial area narrow, widened in the middle. Length, 0.027 mm., breadth 0.015. The type *Navicula arctica* has radiate striae.

NAVICULA PSEUDOTIFORVIS Rastedt. Plate 4, fig. 15

Navicula pseudotiforvis (Rastedt) Bac far (1930) 291, fig. 49.

Valve broad elliptical, about circular. Striae radiate, 18 in 0.01 mm. Length 0.0085 mm., breadth 0.007. Known from Europe.

NAVICULA CRYPTOCOEPHALA Kütz. Plate 16, fig. 3.

Navicula cryptocoephalata Kütz., Fr. HUSTEDT, Bac. Far. (1930) 290 fig. 496.

Valve lanceolate, attenuate. Striae radiate, 18 in 0.01 mm Length, 0.02 mm; breadth, 0.005. Common in fresh water

NAVICULA CRYPTOCOEPHALA Kütz. var. VENETA (Kütz.) Grun. Plate 7, fig. 1.

Navicula cryptocoephalata Kütz. var. *veneta* (Kütz.) Grun. Fr. HUSTEDT, Bacillar. (1930) 295, fig. 497a.

Valve lanceolate, attenuate. Striae radiate, 13 to 14 in 0.01 mm. Axial area narrow Length, 0.023 mm., breadth, 0.005 Common in fresh water.

NAVICULA SALINARUM Grun. var. NIPPONICA var. var. Plate 5, fig. 21

Valve lanceolate, elliptical and acuminate. Striae robust, 9 in 0.01 mm, in the middle of unequal length. Length, 0.03 mm, breadth, 0.0085. The typical *Navicula salinarum* has the striae 14 to 16 in 0.01 mm and is known from brackish water

NAVICULA RHYNOCEPHALA Kütz. Plate 5, fig. 2

Navicula rhynchocephala Kütz., Fr. HUSTEDT, Bacillar. (1930) 296, fig. 501

Valve lanceolate with attenuate ends. Striae radiate, 12 to 13 in 0.01 mm. Axial area narrow Length, 0.035 mm breadth, 0.0085. Reported from many parts of the world

NAVICULA ROSTELLATA Kütz. Plate 5, fig. 3.

Navicula rostellata Kütz., A. SCHMIDT, Atlas Diatom. pl. 47 figs. 27-30.

Valve lanceolate with attenuate ends. Striae radiate in the middle, of unequal length, 11 in 0.01 mm. Length, 0.035 mm breadth, 0.0076. Known from Nippon.

NAVICULA ROSTELLATA Kütz. var. NIPPONICA var. var. Plate 5, fig. 22

Valve more attenuate with slightly capitate ends. Striae 9 to 10 in 0.01 mm. Length, 0.028 mm; breadth, 0.006. Differs from the type in its margins and capitate ends. Uncommon.

NAVICULA RADIOSA Kütz. Plate 5, fig. 3.

Navicula radiosata Kütz., Fr. HUSTEDT, Bacillar. (1930) 299, fig. 513

Valve narrow-lanceolate, acuminate. Striae 9 in 0.01 mm Length, 0.072 mm; breadth, 0.01. Common in fresh water

NAVICULA MENISCULUS Schumann. Plate 5, fig. 16.

Navicula menisculus Schumann, Fr. HUSTEDT, Bacillar. (1930) 301 fig. 517.

Valve lanceolate, broad. Striae 12 to 14, not areololate, 9 in 0.01 mm of unequal length in the middle. Central area broad. Length 0.016 mm, breadth 0.013. Common

NAVICULA GLOBULIFERA Hust. Plate 5, fig. 6

Navicula globulifera H. STETT. Bact. et. nov. gen. nov. in Japon. 164, p. 5, fig. 7

Valve lanceolate with capitate ends. Striae divergent in the middle convergent at the ends. The middle some 8 to the end striae 14, in 0.01 mm. Length 0.068 mm, breadth 0.01. Only known from Nippon

NAVICULA GLOBULIFERA Hust. var. **NIIPPONICA** var. nov. Plate 5, fig. 10

Valve more elongate with noncapitate ends. Striae 12 in 0.01 mm. Length, 0.083 mm, breadth 0.01. Differs from the type in its attenuate and noncapitate ends.

NAVICULA FALAFIENSIS Grun. var. **LANCEOLA** Grun. Plate 5, fig. 9

Navicula lanceolata Grun. var. *lanceola* Grun. in Japon. G. N. FR. HUSTEDT Bo. Far. 1739, 402, fig. 524

Valve, near-lanceolate with rounded and acute ends. Striae fine, radiate 18 to 22 in 0.01 mm. Axial area very narrow. Central area small. Length, 0.017 mm, breadth 0.01. Reported from slightly brackish and fresh waters.

NAVICULA FALAFIENSIS Grun. var. **NIIPPONICA** var. nov. Plate 6, fig. 15

Valve lanceolate, rostrate. Striae fine, slightly radiate, 18 in 0.01 mm. Axial area very narrow. Differs from the type in its subrostrate or rostrate ends and different number of striae.

NAVICULA DICEPHALA (Ehr.) W. Smith. Plate 5, fig. 4

Navicula dicephala (Ehr.) W. Smith, FR. H. STETT. Bact. Far. 1930, 302, fig. 526.

Valve, near-lanceolate with rostrate ends. Striae radiate, 17 in 0.01 mm. Length 0.032 mm, breadth, 0.012. Common

NAVICULA EXCELA Grun. O. Muell. Plate 4, fig. 9

Navicula excea Grun. O. M. L. FR. HUSTEDT var. nov. 1931, 365, fig. 638.

Valve, near-lanceolate with capitate ends. Striae 16 in 0.01 mm. Length 0.017 mm, breadth, 0.00. A fresh water diatom.

NAVICULA SIMULIS Kraske. Plate 5, fig. 12

Navicula simulis Kraske FR. H. STETT. Bact. Far. 1930, 304, fig. 528.

Valve minute, lanceolate with acute ends. Striae distinct 17 in 0.01 mm. Axial and central areas narrow. Length 0.01 mm, breadth 0.005. Reported from Europe.

NAVICULA ANGLICA Ralfs. Plate 5, fig. 18.

Navicula anglica Ralfs. Fr. HUSTEDT Bacilicar (1930) 303, figs. 560-561

Valve elliptic with rostrate ends. Striae slightly radiate, 12 to 13 in 0.01 mm. Axial area narrow widened in the middle part. Length 0.022 mm, breadth 0.008. Common in fresh water.

NAVICULA PLACENTULA Ehren. Grun. to ROSTRATA A. Mayer. Plate 6, fig. 5

Navicula placenta (Ehren.) Grun. to *rostrata* A. Mayer. Fr. HUSTEDT Bacilicar (1930) 304, fig. 583.

Valve elliptical-lanceolate with rostrate ends. Striae robust, 7 in 0.01 mm. Length, 0.062 mm. breadth 0.023. Reported from Europe, Siberia, New Zealand, and America.

NAVICULA PLACENTULA (Ehren.) Grun. to NIPPONICA sp. nov. Plate 10, fig. 20.

Valve robust, short-lanceolate with rostrate ends. Striae 12 in 0.01 mm. Length 0.021 mm, breadth 0.012. This form differs from form *rostrata* Mayer in its shorter valve.

NAVICULA LANCEOLATA (Agardh) Kutz. Plate 5, fig. 4. Plate 6, fig. 6.

Navicula lanceolata (Agardh) Kutz. Fr. HUSTEDT Bacilicar (1930) 305, fig. 540

Valve lanceolate, acuminate. Striae lineolate 9 to 12 in 0.01 mm. Length 0.059 to 0.06 mm, breadth 0.0085 to 0.01. Known from Nippon.

NAVICULA LANCEOLATA Agardh. Kutz. var. CYMBIFLA Donk. Cleve. Plate 5, fig. 17.

Navicula lanceolata Agardh. Kutz. var. *cymbifolia* Donk. Cleve. VAN HELMICK Synopsis p. 7 fig. 32

Valve lanceolate acuminate. Striae radiate, lineate, widened in the middle 5 at the ends 8 in 0.01 mm. Length 0.085 mm. breadth 0.013. Reported from Nippon.

NAVICULA HASTA Pantocsek. Plate 4, fig. 1.

Navicula hastata PANTOCSEK. Fossil. Diatom. Ungarn (1903) 3, p. 5. fig. 1, pl. 14, fig. 713

Valve lanceolate with acuteolate, not cuneate rounded ends. Striae lineate, robust 7 to 8 in 0.01 mm, radiate, widened in the middle part. Length 0.096 mm. breadth, 0.017. Our specimens are different from the forms described by Fr. Meister from No. 11 and S. wa Lakes in Nippon.

NAVICULA PEGREGINA Ehren. Ralfs. var. CUNEATA var. nov. Plate 5, fig. 24.

Valve lanceolate, broad with cuneate ends. Striae radiate divergent at the ends 9 in 0.01 mm. Length, 0.049 mm.

breadth, 0.0045. Differs from the type in its broad valve and its ends.

NAVICULA LACUSTRIS Grig. Plate 3, fig. 6; Plate 4, fig. 2.

Navicula lacustris Grig., CLEVE, Diatoms Finland (1893) 34, pl. 2, figs. 3, 12, 14.

Valve elliptical and acuminate. Striae punctate. Length, 0.02 to 0.044 mm; breadth, 0.01 to 0.015. Striae 16 in 0.01 mm. Reported from Europe, Asia, and America.

NAVICULA AMPHIBOLIA Cleve. Plate 3, fig. 20.

Navicula amphibola Cleve, P. K. HUSTEDT, Bacillar. (1930) 309-310, fig. 854.

Valve lanceolate with attenuate ends. Striae punctate, 12 in 0.01 mm. Length, 0.047 mm, breadth, 0.017. Not common in Kizaka Lake.

NAVICULA PATEA sp. nov. Plate 4, fig. 4.

Valve linear, lanceolate, narrow-attenuate with slightly capitate ends. Striae fine, radiate, 15 to 16 in 0.01 mm. Axial and centra areas narrow and linear. Length, 0.029 mm; breadth, 0.0037. Differs from *Navicula radiosa*, *N. cari*, and *N. cincta* in its narrow central area and capitate ends.

NAVICULA KIZAKENSIS sp. nov. Plate 16, fig. 12.

Valve minute, lanceolate, rounded in the middle, attenuate and capitate at the ends. Striae radiate, about 30 in 0.01 mm. Axial area narrow, linear, widened in the middle part. Length, 0.011 mm; breadth, 0.0042. Differs from *Navicula Schadeli* Kraske¹ in its narrow central area and coarser striae.

NAVICULA ERICNI Hasselt sp. elongata sp. nov. Plate 3, fig. 2.

Valve linear-elliptic with parallel margins and cuneate ends. Striae parallel, coarse, 18 to 20 in 0.01 mm. Axial area narrow, linear, widened in the middle part. Length, 0.032 mm; breadth, 0.0068. Differs from the type in its longer valves. The type is reported from Aokiko Lake, Nippon.

PINNULARIA LEPTOKOMA Grun. Plate 5, fig. 5.

Pinularia leptokoma Grun., P. K. HUSTEDT, Bacillar. (1930) 316, fig. 507.

Valve linear, narrowed towards the ends. Striae radiate, 15 in 0.01 mm. Length, 0.032 mm; breadth, 0.005. A freshwater species, especially of alpine regions.

¹ Beiträge zur Kenntnis der Diatomeenflora Sachsen (1929) 256, fig. 1a, b.

PINNULARIA LEPTOSOMA Grun. var. NIPPONICA var. nov. Plate 6, fig. 15.

Valve linear, attenuate. Striae fine, 14 in 0.01 mm. Area area narrow, central area a broad fascia. Length, 0.066 mm; breadth, 0.0068. Differs from the type in its longer valves.

PINNULARIA MOLARIS Grun. Plate 6, fig. 13.

Pinnularia molaris Grun., Fr. Illustrat., Bacillar (1930) 316, fig. 568

Valve minute, lanceolate, with radiate striae 18 in 0.01 mm. Length, 0.025 mm, breadth, 0.005. Common in fresh water

PINNULARIA MICROLEPTA (Ehr.) W. Smith. Plate 2, fig. 19; Plate 12, fig. 11.

Pinnularia microlepta (Ehr.) W. Smith., Fr. Illustrat. Bac. pr. (1930) 319, fig. 573.

Valve trinodulate with capitate ends. Striae radiate, 10 to 12 in 0.01 mm. Length, 0.022 mm; breadth, 0.006 to 0.012. Common

PINNULARIA DIVERGENTISSIMA Grun. Plate 12, fig. 14.

Pinnularia divergentissima Grun., VAN HEURCK, Synopsis (1880-1881) pl. 6, fig. 32.

Valve linear, attenuate towards the ends. Striae strong, radiate, 15 in 0.01 mm, with a broad fascia. Length, 0.047 mm, breadth, 0.0068. Uncommon

PINNULARIA MICROSTADION (Ehr.) Cleve. Plate 7, fig. 6.

Pinnularia microstadium (Ehr.) Cleve, Fr. Illustrat., Bacillar (1930) 320, fig. 582.

Valve linear-lanceolate with parallel margins and rounded subrostrate ends. Striae radiate, 10 in 0.01 mm. Length, 0.056 mm, breadth, 0.01. Common.

PINNULARIA MICROSTADION (Ehr.) Cleve var. AMBREGA Meister fo. DIMINUTA Grun. Plate 7, fig. 15.

Pinnularia microstadium (Ehr.) Cleve var. *ambrega* Meister fo. *diminuta* Grun., Fr. Illustrat. Bacillar (1930) 321-322, fig. 585.

Valve lanceolate. Striae radiate, 14 in 0.01 mm. Length, 0.03 mm; breadth, 0.006. Common in fresh water

PINNULARIA MICROSTADION (Ehr.) Cleve var. NIPPONICA var. nov. Plate 6, fig. 5; Plate 9, fig. 10.

Valve undulate with obtuse ends. Striae 10 to 11 in 0.01 mm. Length, 0.045 to 0.056 mm; breadth, 0.0085 to 0.011. Differs from the type in its broad obtuse ends.

PINNULARIA MICROSTADION (Ehr.) Cleve var. KIZAKENSSIS var. nov. Plate 6, fig.

Valve with parallel margins and attenuate ends. Striae robust, 9 to 13 in 0.01 mm. Central area a broad fascia. Length

0.034 to 0.062 mm, breadth, 0.0093 to 0.013. Differs from the type in its attenuate ends. Common in Kzak. Lake.

PENNULARIA KARELIKA Cleve var. **JAPONICA** Hustert. Plate 6, fig. 4.

Pinnularia karelika Cleve var. *japonica* Hustert. *Bacillar. d. Aokik.* 166, pl. 5, fig. 3.

A distinct form with slightly capitate ends. Striae 14 in 0.01 mm, crossed by a band. Length, 0.061 mm; breadth, 0.012. Known from Aokiko Lake.

PENNULARIA KARELIKA Cleve var. **JAPONICA** Hustert. *Sc. nov.* Plate 6, fig. 2.

A small obtuse form, with striae 12 to 13 in 0.01 mm, with narrow axial area. Length, 0.044 mm; breadth, 0.013. Uncommon.

PENNULARIA KARELIKA Cleve var. *INST. LARII* var. *nov.* Plate 6, fig. 3.

Valve linear with capitate ends. Striae 8 to 9 in 0.01 mm, crossed by a narrow band. Central area elliptical. Differs from variety *japonica* Hustert in its broad axial area and larger valve.

PENNULARIA LEGGIERI Ehr. Plate 5, fig. 6.

Pinnularia leggierei Ehr., FR. HUSTEDT Bacill. (1930) 322, fig. 567.

Valve strongly triangulate with capitate ends. Striae 8 in 0.01 mm. Length, 0.088 mm, breadth 0.014. Reported from Nippon.

PENNULARIA LEGGIERI Ehr. var. **NIPPONICA** var. *nov.* Plate 7, fig. 4.

Valve with slightly undulate margins. Striae 10 in 0.01 mm. Length, 0.078 mm; breadth, 0.015. Differs from the type in its broader and more obtuse valve.

PENNULARIA PLATYCEPHALA (Ehr.) Cleve. Plate 6, fig. 1.

Pinnularia platycephala (Ehr.) Cleve, FR. HUSTEDT Bacillar. (1930) 326, fig. 593.

A robust species with triangulate margins. Striae divergent in the middle, convergent at the ends, 8 in 0.01 mm. Length, 0.09 mm, breadth, 0.019. Common in lakes.

PENNULARIA PLATYCEPITALIA (Ehr.) Cleve var. **HATTORIANA** Meister. Plate 6, fig. 2.

Pinnularia platycephala (Ehr.) Cleve var. *Hattorianae* Meister. *Bacillar. Japanus* (ID) 2, 228-229 pl. 8, figs. 6, 7.

A distinct diatom with capitate ends and large comma-shaped terminal fissures. Length, 0.070 mm; breadth, 0.01. Striae 8 in 0.01 mm. This diatom was named by Dr. Fr. Meister in

honor of D. Hattori, of the Botanical Institute, Imperial University, Tokyo.

PINNULARIA MONTANA Hust. in MEXIC. &c. nov. Plate 9, fig. 9.

Valve lanceolate. Striae short, 8 to 9 in 0.01 mm. Length 0.051 to 0.068 mm, breadth, 0.012 to 0.015. Lor pitidinal band indistinct. The typical *Pinnularia montana* was described from Aokiko Lake and is twice as large (length, 0.12 to 0.15 mm).

PINNULARIA BREVOSTRATA Cleve. Plate 12, fig. 1.

Pinnularia montana Hustedt var. *sinica* SKVORTZOV. A new synonym of South China (1929) 43, pl. 2, fig. 14, pl. 3, fig. 13.

Valve linear with obtuse ends. Striae parallel, with a longitudinal band, 10 to 11 in 0.01 mm. Length, 0.105 mm, breadth, 0.017. Reported from Foochow, southern China.

PINNULARIA GIBBA Ehr. Plate 7, figs. 2 and 3.

Pinnularia gibba Ehr., Fa. Hustedt, Bacillar (1930) 321 fig. 600a, b.

Valve lanceolate with capitate ends. Central area a broad fascia. Length, 0.066 to 0.068 mm; breadth, 0.008 to 0.01. Striae 9 to 11 in 0.01 mm. Common in fresh water.

PINNULARIA GIBBA Ehr. fo. **SUBUNDULATA** Mayer. Plate 7, fig. 15.

Pinnularia gibba Ehr. fo. *subundulata* Mayer, Fa. Hustedt Bacillar (1930) 327, fig. 601.

Valve slightly triundulate with rostrate, minutely capitate ends. Striae divergent in the middle, convergent at the ends, 8 in 0.01 mm. Length, 0.069 mm; breadth, 0.01. Common.

PINNULARIA GIBBA Ehr. var. **NIKKONICA** var. nov. Plate 7, fig. 18.

Valve slightly triundulate, ends little capitate. Striae radiate, 12 in 0.01 mm. Central area round. Length, 0.095 mm; breadth, 0.013. Differs from the type in its triundulate margins.

PINNULARIA OKAMURAE sp. nov. Plate 7, fig. 19.

Valve linear with attenuate ends. Striae divergent in the middle part, convergent at the ends, 11 to 12 in 0.01 mm. Length, 0.061 mm; breadth, 0.008. A species related to *Pinnularia gibba* var. *linearis* Hustedt. Named in honor of the late Prof. Dr. K. Okamura, director of the Imperial Fisheries Institute, Tokyo.

PINNULARIA BOREALIS Ehr. Plate 7, fig. 17; Plate 16, fig. 1.

Pinnularia borealis Ehr., Fa. Hustedt, Bacillar (1930) 326 fig. 595.

Valve linear-elliptic with rounded ends. Striae radiate, 6 to 7 in 0.01 mm. Length, 0.027 mm; breadth, 0.0068 to 0.009. Com-

mon on mosses, moist earth, and in fresh water. Known from Nippon.

PINNULARIA HAFPOERIANA Cleve var. *STALOPTERA* var. nov. Plate 16, fig. 11.

A minute form with radiate striae, 9 to 10 in 0.01 mm, which form a stauros in the middle part of the valve. Length, 0.017 mm; breadth, 0.005. Rare. Differs from the type in its larger size and a stauros in the middle part of the valve.

PINNULARIA LIGNITICA Cleve. Plate 19, fig. 26.

Pinnularia lignitica Cleve. Synopsis Navicul. Diatom. (1895) 2, 86. pl. 1, fig. 16.

A distinct species with rhombic valve, short striae 11 to 12 in 0.01 mm, and a broad central area. Length, 0.062 mm; breadth, 0.018. Longitudinal band distinct. Common in Kizaki Lake. Reported as a fossil from Nippon lignite (Brun collections).

PINNULARIA TABELLARIA Ehr. Plate 6, fig. 5.

Pinnularia tabellaris Ehr. A. Scopar. Atlas Diatom. pl. 43, fig. 4.

Valve linear, slightly gibbous in the middle. Striae parallel, convergent at the ends, 10 in 0.01 mm. Axial area linear, central area elliptic. Length, 0.244 mm; breadth, 0.019. Known from North America, Brazil, Siberia, and South Africa.

PINNULARIA HASTATILIS Meister. Plate 8, fig. 3.

Pinnularia hastatilis Meister. Seltene und neue Kieselalgen (1934) 102, fig. 82.

Valve linear with capitate ends. Axial area linear, widened in the middle. Striae 9 in 0.01 mm. Length, 0.221 mm; breadth, 0.017. Reported only from Canton River, southern China.

PINNULARIA MASONI (Kutz.) Cleve. Plate 6, fig. 16.

Pinnularia masoni (Kutz.) Cleve. Pl. Hustedt, Bacillar. (1930) 32, 614.

Valve linear, slightly gibbous in the middle. Length, 0.161 mm, breadth, 0.022. Striae 7 in 0.01 mm. Common in fresh water. Known from Nippon.

PINNULARIA MAJOR (Kutz.) Cleve var. *LINKEA* Cleve. Plate 2, fig. 11.

Pinnularia major (Kutz.) Cleve var. *linearis* Cleve, Parvocsek, Fas. & Baccharien Ungaria (1905) 3, pl. 2, fig. 113.

Valve broad-linear with parallel margins. Striae 9 in 0.01 mm. Length, 0.127 mm; breadth, 0.02. Common.

PINNULARIA VIRIDIS (Nitsch.) Ehr. var. LEPTOGONGYLA Ehr. Griseb. Cleve Plate 6, fig. 1.

Pinnularia leptogongyla A. SCHMIDT Atlas Diatom (1876) p. 45. figs. 26-28.

Valve linear with attenuate ends. Striae 7 to 8.5 in 0.01 mm with a distinct band. Central area broad axial area one-third of the breadth of the valve. Known from brackish waters of Europe.

PINNULARIA VIRIDIS (Nitsch.) Ehr. var. INTERMEDIA Cleve. Plate 7, fig. 2.

Pinnularia sp. A SCHMIDT Atlas Diatom (1876) p. 42 figs 9-10.

Valve large with two longitudinal bands. Central area broad Length, 0.105 mm, breadth 0.017. Striae 8 to 11 in 0.01 mm Common in fresh water

PINNULARIA VIRIDIS (Nitsch.) Ehr. var. PALLAS Cleve. Plate 9, fig. 7. Plate 12, fig. 18.

Noecula sp. A SCHMIDT, Atlas Diatom (1876) pl. 43, fig. 26 pl. 46, figs. 10-11.

Valve linear narrowed towards the ends. Striae 9 to 11 in 0.01 mm without longitudinal band. Central area with a short striae or shortened stria. Length 0.045 to 0.040 mm breadth 0.01. Common

PINNULARIA V. RODIS Nitsch. Ehr. var. SIBETICA Huse, HULSTEDT Plate 6, fig. 2.

Pinnularia viridis Nitsch. Ehr. var. *sibirica* Huse, HULSTEDT Bacter (1930) 335 fig. 61b.

A form with coarse striae, 9 in 0.01 mm, with a longitudinal band. Axial and central areas linear. Known from fresh water in Europe

PINNULARIA VIRIDIS (Nitsch.) Ehr. var. NIPPONICA var. nov. Plate 6, fig. 14. Plate 8, fig. 2.

Valve lanceolate with complex median line. Striae 6 to 7.5 in 0.01 mm. Length, 0.081 to 0.09 mm. breadth, 0.018. This new variety differs from the type in its striae without the longitudinal band. Common in Kizaki Lake.

PINNULARIA UENO sp. nov. Plate 7, fig. 1.

Valve boat-shaped, elliptical-lanceolate with parallel margins and obtuse subrostrate ends. Striae robust radiate, situated in the middle to a transverse fascia, 9 in 0.01 mm. Median line slightly arcuate. Terminal fissures comma-shaped. Axial area somewhat elevated in the middle. Central pores distinct. Length, 0.062 mm, breadth, 0.013. Named in honor of Dr. Masao Ueno, of Otsu, Nippon.

PINNULARIA NIPPONICA sp. nov. Plate 7, fig. 12.

Valve slightly undulate, with truncate ends. Striae robust, rad. ate. 8 in 0.01 mm. Central area a fascia. Median line flexuous. Terminal fissures comma-shaped. Axial areas linear. Length, 0.072 mm; breadth, 0.018. Uncommon.

PINNULARIA DACTYLUS Ehr. var. DARIANA A. S. Gr. NIPPONICA sp. nov. Plate 7, fig. 13.

Valve lanceolate with obtuse ends. Length, 0.122 mm; breadth, 0.22. Median line not complex. Axial area broad, widened in the middle part. Striae divergent in the middle, convergent at the ends, 8 in 0.01 mm. The type form has the valve 0.18 to 0.21 mm in length with striae crossed by a broad band. Variety *Dariana* is reported from America.

PINNULARIA MOBILIS Ehr. Plate 19, fig. 1.

Pinnularia mobilis Ehr., Fr. Histoire. Bacillar. (1920) 337, fig. 618.

Valve linear, slightly gibbous in the middle, with rounded ends. Length, 0.204 mm; breadth, 0.03. Striae 6 in 0.01 mm. Common.

PINNULARIA HARTMAYERANA Grunb. Plate 4, fig. 3.

Pinnularia Hartmayerana Grunb., Descriptions of new and rare diatoms. T. M. S. 13 (1865) pl. 6, fig. 30, A. Schmidl. Atlas Diatom. (1912) pl. 33 figs. 1, 2. G. B. De Toxi and F. L. Porta, Algae di Australia, Tasmania e Nuova Zelanda (1923) 145, fig. 6.

Valve robust undulate in the middle and on the ends. Length, 0.12 mm; breadth, 0.016. Ends cuneate. Striae divergent in the middle convergent at the ends, 9 in 0.01 mm. Central area a rectangular fascia. Axial area enlarged around the central nodule and expanded at the ends. The Nippon form is smaller than the type. *Pinnularia Hartmayerana* has been reported from Liberia and Kalahari in Africa, Demerara River in South America, Wakaruvareva in New Zealand, and Aokiko Lake in Nippon.

AMPHORA OVALIS Kütz. var. CRASSA (Gmel.) Grunb. Plate 3, fig. 14.

Amphora sp. A. Schmidl. Atlas Diatom. (1873) pl. 26, fig. 101.

Frustule elliptic. Length, 0.02 mm; breadth, 0.0085. Striae 16 in 0.01 mm. Common in fresh water.

AMPHORA OVALIS Kütz. var. PEDICELLA Ehr. Plate 3, fig. 15.

Amphora ovalis Kütz. var. *pedicellata* Kütz., Fr. Histoire. Bacillar. (1920) 343, fig. 622.

Frustule elliptic. Valve lunate. Length, 0.012 mm, breadth 0.0076. Striae 18 in 0.01 mm. Common in fresh and brackish waters. Known from Nippon.

AMPHORA OVALIS Rupp var. LIBYC A. Schmid. Plate 3, fig. 7

Amphora libica Ehr. A. Schmidt Atlas Diatom. 1876, p. 26, fig. 10.

Valveolate. Length 0.035 mm, breadth, 0.0068. Striae 14 in 0.01 mm. Median line arcuate. Central area distinct, on the dorsal side frequently meeting with a blank band across the striae. Common in fresh and brackish waters.

AMPHORA PERPLEXA Grun. Plate 3, fig. 13.

Amphora perplexa Grun. Fa. H. Staubt, Bac. Inv. (1880) 317, fig. 627.

Frustule elliptic. Length, 0.005 mm; breadth 0.0025. Common in fresh water and moist earth.

AMPHORA NORMANII Rupp. Plate 3, fig. 11.

Amphora Normanii Rupp, Fa. H. Staubt, Bac. Inv. (1880) 13, fig. 630.

Frustule elliptic, truncate. Valve narrow-lanceolate, and capitate. Central nodule strong. Length, 0.024 mm; breadth, 0.0084. Striae 18 to 20 in 0.01 mm. Common in moist earth.

AMPHORA DELPHINIA Hustedt & S. var. MINOR Cleve. Plate 3, fig. 12.

Amphora delphinia Hustedt, A. Schmidt Atlas Diatom. (1876, p. 40) fig. 12.

Frustule elliptic-rectangular with parallel margins. Length, 0.017 to 0.03 mm; breadth, 0.016. Valve linear with rounded ends. Central nodule dilated to a sinuosity. Median line arcuate. Striae almost parallel, 24 in 0.01 mm. Known from Crane Pond, North America, and from Demerara River, South America. Common in Kizak, Lake.

CYANELLA MICROCEPHALA Grun. Plate 11, fig. 25.

Cymbella microcephala Grun. Fa. Hustedt, Bac. Inv. (1880) 351, fig. 639.

Valve linear with rostrate-capitata ends. Length, 0.017 mm; breadth, 0.0034. Striae very fine, 28 in 0.01 mm. Common in fresh water.

CYANELLA ALPINA Grun. Plate 12, fig. 19.

Cymbella alpina Grun. A. Schmidt Atlas Diatom. 1876, p. 373, fig. 17.

Valve slightly asymmetrical, lanceolate. Length, 0.040 mm; breadth, 0.01. Striae 8 in 0.01 mm. Common in alpine regions.

CYANELLA REINHOLDII Grun. Plate 6, fig. 1.

Cymbella Reinholdii Grun. Fa. H. Staubt, Bac. Inv. (1880) 354, fig. 644.

Valve slightly asymmetrical, elliptic-lanceolate, with convex dorsal and ventral margins. Axial, and central areas broad.

Length, 0.032 mm breadth 0.019 Striae 15 in 0.01 mm
Known from Europe

CYMBELLA EBRENBURGII Kutz. Plate 1, fig. 2

Cymbella Ebrenberg Nutt. FR. ILLUSTRAT. BOTANIC. 1830, p. 656

Valve elliptic lanceolate. Length 0.105 mm breadth 0.03 Striae 9 in 0.01 mm Common in fresh water

CYMBELLA NAVICULIFORMIS Auerwald. Plate 1, fig. 6.

Cymbella naviculiformis Auerwald. FR. ILLUSTRAT. BOTANIC. 1830, p. 656 fig. 63

Valve navicular form lanceolate with capitate and constricted ends Length 0.032 mm breadth, 0.0085 Striae 12 in 0.01 mm Central area circular Common in Kizak Lake Known from a few regions.

CYMBELLA ESPADATA Kutz. Plate 1, fig. 23.

Cymbella espadata Kutz. A. SCHMIDT Atlas Diatom. 93, p. 374 figs. 13, 14.

Valve slightly asymmetric with rostrate-capitate ends Length, 0.034 to 0.071 mm width, 0.012 to 0.02 Striae 8 to 0.01 mm Known from Nippon

CYMBELLA HETEROLEURA Ehren. var. **MINOIC** Cleve. Plate 11, fig. 4.

Cymbella sp. A. SCHMIDT A. SCHMIDT (1875, p. 1) figs. 1-2

Valve slightly asymmetric, lanceolate with rostrate ends Length 0.074 mm width 0.022 Central area large Striae 8 to 0.01 mm Known from fresh waters of far northern regions

CYMBELLA HETEROPORA Ehren. & **NIPPONICA** sp. nov. Plate 1, fig. 13.

Valve linear lanceolate, attenuate, and with truncate ends Length 0.04 mm breadth 0.01 Striae 8 to 9 in 0.01 mm truncate Axial area linear ventral area circular Differs from the type in its small valve

CYMBELLA PROSTHATA Berkeley Cleve. Plate 10, fig. 23.

Cymbella prosthata Berkeley Cleve. FR. ILLUSTRAT. BOTANIC. 1830, p. 658 fig. 659

Valve asymmetric with elevated dorsal and erose acute ventral margins Median line arcuate with long terminal fissures Axial area lanceolate Striae punctate 7 ventral 6 dorsal, 0.01 mm Common in fresh and brackish waters

CYMBELLA TURGIDA (Greg.) Cleve. Plate 11. fig. 26.

Cymbella turgida (Greg.) Cleve, Pl. Hest. 1890: 258
fig. 660.

Valve lunate, with arcuate dorsal margin, slightly gibbose ventral margin. Length, 0.054 mm; breadth, 0.014. Striae 6 to 9 in 0.01 mm. Known from Aokiko Lake. Common in tropical regions.

CYMBELLA VESTRHOUSA Kütz. Plate 11. figs. 14 and 15.

Cymbella vestrhousea Kütz., Pl. Hest. 1890: 358, fig. 661.

Valve lunate with straight or slightly gibbose ventral margin. Length, 0.025 to 0.032 mm; breadth, 0.006 to 0.007. Striae 10 to 12 in 0.01 mm. Very common in fresh water.

CYMBELLA GRACILIS Ralfs. Plate 11. fig. 5.

Cymbella gracilis Ralfs., VAN HEURCK, Synopsis (1880-1881): pl. 3, figs. 20-21.

Valve narrow with slightly arcuate dorsal, and straight ventral, margins. Length, 0.062 mm, breadth, 0.008. Striae 12 to 0.01 mm. Found in fresh water, especially in alpine regions.

CYMBELLA GRACILIS (Ralfs.) Cleve var. MINOR Kütz. nov. Plate 12. fig. 22.

Like the type, but smaller. Length, 0.018 mm; breadth, 0.005. Striae 12 in 0.01 mm. Median line approximate to the ventral margin. Uncommon.

CYMBELLA AEGALIS W. Sm. Plate 2. fig. 5; Plate 11. fig. 2.

Cymbella obtusa Greg., 4. SCHMIDT, Atlas Diatom. (1875) pl. 9, figs. 41-45.

Valve naviculiform and subclavate. Length, 0.032 to 0.042 mm; breadth, 0.0065 to 0.009. Striae radiate, 12 to 15 in 0.01 mm. Common in alpine regions. Known from Aokiko Lake.

CYMBELLA SINUATA Greg. Plate 11. fig. 12.

Cymbella sinuata Greg., Pl. Hest. 1890: 361, fig. 668a.

Valve linear, slightly asymmetrical, gibbose in the middle with obtuse ends. Length, 0.02 mm; breadth, 0.005. Striae 12 in 0.01 mm. Reported from Aokiko Lake.

CYMBELLA SINUATA Greg. var. ANTIQUA Grun. Plate 9. fig. 13.

Cymbella sinuata Greg. var. *antiqua* Grun., PANTOCSEK, Fossae Bacter. Ungar. (1905) 141, pl. 29, fig. 31.

Valve linear with capitate ends. Length, 0.018 mm; breadth, 0.0068. Striae 5 to 6 in 0.01 mm. The typical variety *antiqua* is larger, being 0.032 to 0.033 mm in length. Known only as a fossil from Hungary.

CYMBELLA TURCICA Grun. Plate 11, fig. 24

Cymbella turgidula Grun. A. SCHMIDT, Atlas Diatom. 1875, pl. 9, figs. 23-26.

Valve asymmetrical, with rostrate and obtuse ends. Length 0.029 mm, breadth 0.011. Striae 9 to 10 in 0.01 mm. On the ventral side of the central nodule are wavy parallel. Known from the Tropics.

CYMBELLA AFF. NIS KÜTZ. Plate 11, figs. 9 and 10.

Cymbella affinis KÜTZ., F. H. HUSTEDT Bactar. 1930, 362, fig. 61.

Valve cymbiform with truncate ends. Length, 0.035 to 0.050 mm, breadth, 0.0085 to 0.012. Striae 8 to 10 in 0.01 mm. Known from Nippon.

CYMBELLA HYBRIDA Grun. Plate 5, fig. 21.

Cymbella hybrida Grun., CLEVE Synopsis Navic. Diatoms, 1894, 1, 196, pl. 4, fig. 23.

Napula rhytidocerpha KÜTZ. var. *hankensis* SK. S. S. Diatoms Hail Lake (1929), 49, pl. 4, fig. 22.

Valve navicular form, ear with parallel margins and truncate ends. Striae lineolate divergent in the middle, convergent at the ends. 9 in 0.01 mm. The median stria opposite the stigma, shortened. Axial area narrow, near widened in the middle. Length, 0.068 mm; breadth 0.0085. Known from fresh water and very slightly brackish water in Sweden reported from Hail Lake Siberia. Common in Kizaki Lake.

CYMBELLA JAPONICA Reichen. Plate 10, fig. 4. Plate 1, fig. 2 and

Cymbella japonica Reichenb. A. SCHMIDT, Atlas Diatom. (1931) p. 117, figs. 20-21.

Cymbella signata P. T. var. *chrysostoma* S. S. S. Diatoms from South China (1929), 46, pl. 9, fig. 21.

Valve subelliptical sublavate with a terminal rounded end. Length, 0.042 to 0.08 mm; breadth, 0.012 to 0.014. Striae robust slightly radiate, 6.5 to 8 in 0.01 mm. distinct inolate. Median line arcuate, broad with reflexed terminal fissures. Near the central nodule one stigma. Known from Yokohama on up toes in Aokiko Lake, and common in Kizaki Lake. Reported from a mountain stream near Foochow southern China.

CYMBELLA CYMIFORMIS (Agardh, Ritter) VAN HEUREK. Plate 8, fig. 2.

Cymbella cymiformis (Agardh, Ritter) VAN HEUREK. F. H. HUSTEDT Bactar. (1930) 362, fig. 674.

Valve boat-shaped, with slightly gibbose ventral margin and obtuse, truncate ends. Length 0.051 to 0.076 mm. Striae,

0.008 to 0.015. Striae 7 to 10 in 0.1 mm. At the ventral side of the central nodule a distinct isolated punctum. Common in fresh water. Known from Nippon.

CYMBELLA CISTI A. Henmuth Grun. Plate 5, fig. 20

Cymbella cistica (Hemp.) Grun. VAN HEERK Synopsis (1880-1881) p. 2, fig. 2.

Valve cymiform. Length, 0.050 to 0.093 mm., breadth, 0.013 to 0.017. On ventral side one or two isolated puncta. Common in fresh water.

CYMBELLA ASPLICA Ehr. Clev. var. **TRUNCATA** Rabh. Dippel. Plate 9, fig. 19.

Unter der geschilderten var. truncata (Rabh.) Dippel A. MAYER Die Bacillen d. Regenwässer schwässer 1913) 262, p. 13, fig. 20.

Valve cymbiform with truncate ends. Length 0.13 mm. Breadth, 0.020. Stipe 8 in 0.01 mm. Common.

CYMBELLA MEDA Breb. van Heerck. Plate 1, fig. 21.

Cymbella meda (Breb.) Van Heerck in Hustedt Bacill. 930, 366, fig. 677.

Valve boat-shaped with rostrate-truncate ends. Length 0.057 mm. breadth, 0.017. Stipe 9 in 0.01 mm. Reported from Nippon.

CYMBELLA MEDA Breb. Van Heerck var. **BOREALIS** Grun. Plate 1, fig. 16.

Cymbella meda (Breb.) Van Heerck var. *borealis* Grun. SKVORTZOW Diatoms of Hanka Lake (1929) p. 7, fig. a.

Valve cymbiform and truncate. Length 0.085 mm., breadth, 0.017. Stipe 8 in 0.01 mm. Common in fresh water.

CYMBELLA KAWAMURA R.P. sp. nov. Plate 15, fig. 10.

Valve navicular form, aereolate, with attenuate and capitate ends. Stipe strong, radiate, not striate, in the middle of unequal length 12 in 0.01 mm. Axial area very narrow, central capitate with two isolated puncta. Length, 0.027 mm. breadth 0.009. A distinct species, named in honor of Prof Dr T Kawamura of Kyoto Nippon.

COMPHONEMA VAST M. Hustedt. Plate 3, fig. 3.

Comphonema vastum H. HEDDST. Boettcher et al. Aokiko in Japan 166, p. 5, fig. 4.

Valve cavate with slightly capitate apex and narrow base. Length, 0.028 mm. breadth, 0.006. Stipe short, marginal 12 in 0.01 mm. Axial area broad. Central area with one isolated punctum. Reported only from Aokiko Lake, Nippon.

GOMPHONEMA VASTUM Boudet var. *CONFICATA* var. *var* nov. Plate 10, fig. 11

Valve with cuneate apex. Length, 0.039 mm., breadth, 0.005 mm. Striae 15 in 0.01 mm.

GOMPHONEMA VASTUM Boudet var. *CONFICATA* var. *var* nov. Plate 3, figs. 33 and 34

Valve with elongate apex. Length, 0.028 to 0.034 mm., breadth, 0.005 to 0.006 mm. Striae 12 to 17 in 0.01 mm. Common in Kizaki Lake.

GOMPHONEMA ACUMINATUM Ehr. Plate 13, fig. 39

Gomphonema acuminatum Ehr., FR. HUSTEDT Bact. Bar. (1930) 370 fig. 683

Valve excavate and biconstricted. Striae 10 to 11 in 0.01 mm. Length, 0.034 mm., breadth, 0.005 mm. Common in fresh water.

GOMPHONEMA ACUMINATUM Ehr. var. *TURRIS* Ehr. Cleve. Plate 12, fig. 4

Gomphonema acuminatum var. *turris* (Ehr.) Cleve. A. SCHMIDT Atlas Diatom. (1902) pl. 289, figs. 34-36

Valve slightly biconstricted. Striae 16 to 18 in 0.01 mm. Length, 0.047 mm., breadth, 0.005 mm. Common in fresh water. Rare in Kizaki Lake.

GOMPHONEMA ACUMINATUM Ehr. var. *CORONATA* Ehr. W. Smith. Plate 12, fig. 8

Gomphonema acuminatum Ehr. var. *coronata* Ehr. W. Smith FR. HUSTEDT Bact. Bar. (1930) 370 fig. 684

Valve slightly biconstricted, elongate. Length, 0.069 mm., breadth, 0.01 mm. Rare in Kizaki Lake.

GOMPHONEMA PARVUM M. Kutz. Grun. Plate 13 figs. 16 and 34.

Gomphonema parvum (Kutz.) Grun. A. SCHMIDT Atlas Diatom. (1902) p. 234, fig. 14.

Valve elliptic-elevate with capitate ends. Length, 0.02 mm., breadth, 0.0065. Striae 14 to 15 in 0.01 mm. Common in fresh water.

GOMPHONEMA PARVULUM Kutz. Grun. var. *EXALBESIMA* Grun. Plate 13 fig. 3

Gomphonema parvulum (Kutz.) Grun. var. *exalbesima* Grun. VAN HEERCK Synops. (1880-1881) pl. 26 fig. 12

Valve narrow, lanceolate. Length, 0.017 mm., breadth, 0.0042 mm. Striae 15 in 0.01 mm. Uncommon.

GOMPHONEMA PARVITUM Kutz. Grun. var. *MICROPS* Kutz. Cleve. Plate 13 fig. 9

Gomphonema parvulum Kutz. Grun. var. *microps* (Kutz.) Cleve. FR. HUSTEDT Bact. Bar. (1930) 373 fig. 7, 36.

Valve slightly elevate with obtuse apex. Length, 0.011 mm., breadth, 0.006. Striae 15 in 0.01 mm.

COMPHONEMA PARVUM Ehr. var. *MICROPIS* Ehr. Citee in NEPRO. NKA to nov. Plate 18, fig. 36.

Valve minute, subovate with obtuse apex. Length, 0.009 mm breadth 0.0029. Striae 18 in 0.01 mm. Isolated puncta few and short. Differs from variety *interiorum* in its closer striae and smaller size.

COMPHONEMA LANCEOLATUM Ehr. var. *INSIGNIS* Grev. cited. Plate 18, fig. 7. Plate 18, fig. 32.

Gomphonema lanceolatum Ehr. var. *insignis* Grev. Citee in Hustedt, Bacter. (1930) 372, fig. 31.

Valve lanceolate, clavate apex acuminate, slightly conic. Length, 0.04 to 0.06 mm. breadth, 0.0065 to 0.015. Striae 8 to 9 in 0.01 mm. Common in fresh water.

COMPHONEMA ALONGI Ehr. Plate 18, fig. 21.

Gomphonema elongatum Ehr. in Hustedt, Bacter. (1930) 372, fig. 688.

Valve clavate with broad truncate apiculate apex. Length, 0.051 mm. breadth, 0.02. Striae 10 in 0.01 mm. Uncommon in Kizaki Lake.

COMPHONEMA ALONGI Ehr. var. *GALTIERI* Van Heek.

Gomphonema elongatum Ehr. var. *Galtieri* Van Heek in Hustedt, Bacter. (1930) 372, fig. 689.

Like the type, but with longer valve. Length 0.061 mm. breadth, 0.01. Common in Kizaki Lake.

COMPHONEMA QUADRIPUNCTATUM (Ostrea) Wissel var. *BASTARDI* Wissel. Plate 18, fig. 31.

Gomphonema quadripunctatum (Ostrea) Wissel var. *Bastardii* Wissel. Neue Untersuchungen über die Diatomeen des Balai-Sees (1924) 166-167 figs. a-c.

Valve clavate with obtuse and broad apex. Length, 0.044 mm. breadth, 0.009. Striae radiate 11 to 13 in 0.01 mm. Several areas a broad fascia with few isolated puncta. Median line straight, with long terminal fissures. Rare. Reported from northern Europe, Baikal Lake, Manchuria and Mongolia.

COMPHONEMA STUTTE Ehr. var. *SACHTTA* Schumann. Plate 18, fig. 19.

Gomphonema subutrile Ehr. var. *sachtta* Schumann, A Series of Atlas Diatoms. 1903, pl. 236, fig. 13.

Valve clavate with slightly capitate apex and narrow base. Length, 0.028 mm. breadth 0.0034. Striae 11 in 0.01 mm. Axial area near. Known from Europe.

COMPHONEMA LINGULATUM Hustedt. Plate 18, figs. 6 and 7.

Gomphonema liratum Hustedt Bacter. v. 4. Aoi-kosei n. Japan 166-167, pl. 5, fig. 5.

Valve clavate with broad, truncate, apiculate apex and narrow base. Length, 0.023 to 0.03 mm; breadth, 0.0068 to 0.008 Striae marginal, 15 in 0.01 mm. No isolated punctum. Known only from Aokiko Lake, Nippon.

COMPHONEMA OBVIALEUM (Lyngb.) Kütz. Plate 12, fig. 22

Gomphonema obvialeum (Lyngb.) Kütz., Fr. Hustedt, Bacillar. (1930) 378, fig. 719.

Valve subclavate with broad, obtuse apex. Length, 0.024 mm, breadth, 0.006. Striae 15 in 0.01 mm. Common in fresh water

COMPHONEMA OBVIALEUM (Lyngb.) Kütz. var. MINUTISSIMA Hustedt. Plate 13, fig. 38.

Gomphonema obvialeum (Lyngb.) Kütz. var. *minutissima* Hustedt, Bacillar. (1930) 378-379, fig. 720.

Like the type, but smaller. Length, 0.01 mm; breadth, 0.004. Striae 15 in 0.01 mm. Uncommon.

COMPHONEMA GRACILE Ehr. var. LANCEOLATA (Hedw.) Cleve. Plate 14, fig. 8.

Gomphonema gracile Ehr. var. *lanceolata* (Kütz.) Cleve, A. Schmid, Atlas Diatom. (1903) pl. 236, figs. 26-28.

Valve lanceolate-clavate, with apiculate apex. Length, 0.036 mm; breadth, 0.0065. Striae 15 in 0.01 mm. In fresh water, common in the Tropics.

COMPHONEMA ABBREVIATUM Agardh Kütz. Plate 13, fig. 42.

Gomphonema abbreviatum Agardh, Kütz., Fr. Hustedt, Bacillar. (1930) 379, fig. 722.

Valve clavate with broad ends. Length, 0.017 mm, breadth, 0.0034. Striae marginal, 15 in 0.01 mm. Axial and central areas uniting in a broad linear-lanceolate space. Reported from fresh and brackish waters.

COMPHONEMA INTRICATUM Kütz. Plate 13, figs. 14 and 43.

Gomphonema intricatum Kütz., A. Schmid, Atlas Diatom. (1903) pl. 236, figs. 16-17.

Valve sub-spear, slightly gibbous in the middle with obtuse apex and base. Length, 0.035 to 0.041 mm; breadth, 0.006 to 0.0085. Striae 12 in 0.01 mm. Common in fresh water.

COMPHONEMA CONSTRICTUM Ehr. Plate 13, figs. 15 and 16.

Gomphonema constrictum Ehr., Fr. Hustedt, Bacillar. (1930) 377 fig. 714.

Valve clavate, biconstricted with rounded, truncate apex. Length, 0.039 to 0.044 mm; breadth, 0.01 to 0.014. Striae 9 to 10 in 0.01 mm. Common in fresh water.

GOMPHONEMA CONSTRUCTUM Ehr. var. **CAPITATA** (Ehr.) Cleve. Plate 13, fig. 13
Gomphonema constructum Ehr. var. *capitata* (Ehr.) Cleve, Fr. Mus. Trop., Bacillar. (1930) 377, fig. 715.

Valve clavate with broad, truncate ends. Length, 0.03 to 0.099 mm, breadth, 0.006 to 0.0085. Striae 12 in 0.01 mm. Common in Kizuki Lake.

GOMPHONEMA BERGGRIMII Cleve. Plate 12, fig. 16.

Gomphonema Berggrimmii Cleve, Synopsis Navicul. Diatoms (1894) 1, 185, pl. 5, figs. 6, 7; A. Schmid, Atlas Diatom. (1903) pl. 240, figs. 26-30.

Valve clavate with broad subtruncate apex. Base elongate, narrow. Length, 0.044 mm, breadth, 0.0085. Axial area with an isolated punctum. The median stria opposite to the isolated punctum is shortened. Only known from fresh water in New Zealand.

GOMPHONEMA NORRONICA sp. nov. Plate 12, fig. 21.

Valve elongate, clavate with subtruncate and constricted apex. Ends long, attenuate, obtuse. Length, 0.056 to 0.06 mm; breadth, 0.0085 to 0.01. Striae robust, 9 in 0.01 mm. Axial area narrow, narrowed to the middle, unilateral. Central area unilateral, opposite to the stigma a broad stauros. Not common in Kizuki Lake. *Gomphonema hohenicum* Reichenb and Fr. c/o and *G. subtilis* Meister are nearly related to this new species.

EPITHEMIA ELEPHANTIS (Ehr.) var. **LUNARIS** Grun. Plate 9, fig. 12.

Epithemia elephantis (Ehr.) var. *lunaris* Grunow, Beiträge zur Kenntniss der fossilen Diatomeen Österreich-Ungarns (1903) 137-138, pl. 20, figs. 1, 2.

Epithemia hyalostoma W. Smith var. *elatior* Steyermark, Alpine Diatoms from South China (1929) 40, pl. 2, figs. 22, 23, pl. 3, fig. 9.

Valve lunate, gibbous on the dorsal side. Ends long, obtuse. Length, 0.057 to 0.06 mm; breadth, 0.011 to 0.014. Costae 3, striae 15, in 0.01 mm. Reported from fresh water in Bengal, India, from Foochow, southern China, and as a fossil from Durbavica, Hungary.

EPITHEMIA ZEBRA (Ehr.) Kütz.

Epithemia zebra (Ehr.) Kütz., Fr. Hustedt, Bacillar. (1930) 384-385, fig. 729.

Valve linear with straight ventral side. Length, 0.085 mm, breadth, 0.01. Costae 4, striae 15, in 0.01 mm. Known from Aokiko Lake.

EPITHEMIA ZEBRA (Ehr.) Kütz. var. **SAXONICA** (Kütz.) Grun. Plate 12, fig. 21

Epithemia zebra (Ehr.) Kütz. var. *saxonica* (Kütz.) Grun., Fr. Hustedt, Bacillar. (1930) 385, fig. 730.

Valve linear curved. The obtuse ends are lightly turned downwards. Length, 0.034 mm, breadth 0.01. Striae 11 to 14 in 0.01 mm. Not common in Kizak Lake.

PP. *THEMIA SORENSENII* PLATE 9, FIG. 2

Epithemia sorense Kutz., FR. H. STEOT. Bact. 1901: 288, fig. 76.

Valve broad, gibbous on the dorsal side, slightly curved on the ventral side. Length, 0.025 mm, breadth 0.008. Common in fresh and brackish waters. Reported from Aokiko Lake, Nippon.

RHOPALODIA CIBBA Ehr. O. Moll. Plate 9, fig. 2

Rhopalodia gibba (Ehr.) M. L. FR. H. STEOT. Bact. 1930: 390, fig. 540.

Valve linear, arcuate, straight on the dorsal side reflexed at the extremities. Costae 6 in 0.01 mm. Length 0.111 mm, breadth 0.0085. Common in Kizak Lake.

RHOPALODIA GIBBA EHR. O. MOLL. PLATE 9, FIG. 17

Rhopalodia gibba (Ehr.) O. Moll. FR. H. STEOT. Bact. 1930: 391, fig. 542.

Valve gibbous in the middle of the dorsal side and straight on ventral side. Length 0.045 mm, breadth, 0.022. A species of brackish waters. Not common in Kizak Lake.

RHOPALODIA PARALLELA Grun. O. Moll. Plate 9, fig. 1. Plate 9, fig. 12.

Rhopalodia parallela Grun. O. Moll. FR. H. STEOT. Bact. 1930: 389-390, fig. 54.

Valve linear with parallel margins. Length 0.062 to 0.2 mm, breadth, 0.018 to 0.03. Costae 5 to 6 in 0.01 mm. Striae 16 in 0.01 mm. At a pure species known from many parts of the world.

NITZSCHIA PONTICOLA Grun. Plate 10, fig. 26.

Nitzschia ponticola Grun. FR. H. STEOT. Bact. 1930: 415, fig. 800.

Valve lanceolate with obtuse ends. Length 0.01 mm, breadth, 0.0034. Costae 12, striae 24, in 0.01 mm. Not common in Kizak Lake.

NITZSCHIA SAGITTATA Ehr. W. Smith. Plate 10, fig.

Nitzschia sagittata (Ehr.) W. Smith. FR. H. STEOT. Bact. 1930: 419, fig. 810.

Valve sigmoid with parallel margins. Length, 0.34 to 0.38 mm, breadth, 0.01. This is the largest *Nitzschia* species in Kizak Lake. Known from Aokiko Lake.

NITZSCHEA INTERRUPTA (Nitzsch.) Hustedt. Plate 13, fig. 1.

Nitzschia moissacensis var. *Heideni* Meister, in Beiträge zur Bacillar-Japonia (1914) 229, pl. 8, fig. 10.

Nitzschia (moissacensis) Herib. var. ² *Heideni* Meister A. SCHMIDT, Atlas Diatom. (1924) pl. 251, figs. 2-13.

Nitzschia denticula GRUUN, Diatom. Vega-Exped. (1883) 492 p. 3 fig. 68.

Denticula interrupta REICHELT, KUNZE, Revision 3, 332, fig.

Valve lanceolate with attenuate and slightly capitate ends. Costae long, irregularly disposed, 5 in 0.01 mm. Striae robust, elongate, 14 to 15 in 0.01 mm. Length, 0.03 to 0.035 mm, breadth, 0.0068 to 0.007. Common in Kizaki Lake. Reported from Aokiko Lake.

NITZSCHEA PALEA (KÜTZ.) W. SMITH. Plate 13, figs. 19 and 20.

Nitzschia palea (KÜTZ.) W. SMITH, Fr. HUSTEDT, Bacillar. (1930) 416, fig. 201.

Valve linear-lanceolate with attenuate ends. Length 0.029 to 0.032 mm; breadth, 0.0025 to 0.0042. Costae 11 to 12 in 0.01 mm. Striae very fine, about 35 in 0.01 mm. Common in Kizaki Lake.

NITZSCHEA PALEA (KÜTZ.) W. SMITH var. *TEPHROSTRIS* GRUUN. Plate 13, fig. 2.

Nitzschia palea (KÜTZ.) W. SMITH var. *tephrostis* GRUUN, SVERDZOW, Diatom recoltees par le Pere E. LICHAT (1935) 43, pl. 9, fig. 40.

Valve linear-lanceolate, slightly constricted in the middle part. Ends slightly capitate. Length, 0.037 mm; breadth, 0.0042. Costae 10 to 11 in 0.01 mm. Striae 35 in 0.01 mm. Not common

NITZSCHEA DISSIPATA (KÜTZ.) GRUUN. Plate 13, figs. 12, 15, and 26.

Nitzschia dissipata (KÜTZ.) GRUUN, A. SCHMIDT, Atlas Diatom. (1921) pl. 332, fig. 23.

Valve linear-lanceolate with attenuate ends. Length, 0.02 to 0.057 mm; breadth, 0.0034 to 0.051. Costae 7 in 0.01 mm. Striae very fine, indistinct. Common in Kizaki Lake.

NITZSCHEA RECTA Hantzsch. Plate 13, fig. 25.

Nitzschia recta Hantzsch, Fr. HUSTEDT, Bacillar. (1930) 411, fig. 785.

Valve linear with truncate, obtuse ends. Length, 0.093 to 0.098 mm; breadth, 0.005 to 0.006. Costae 5 to 6 in 0.01 mm. Striae indistinct. Common in fresh water.

NITZSCHEA COMMUNIS Rabenh. Plate 13, fig. 12.

Nitzschia communis Rabenh., Fr. HUSTEDT, Bacillar. (1930) 417, fig. 798.

Valve broad-lanceolate with obtuse ends. Length, 0.014 mm; breadth, 0.0034. Costae 12 in 0.01 mm. Striae very indistinct. Common in fresh water.

NITZSCHEA CAPITELLATA Böckell var. *NIPPONICA* var. nov. Plate 13, fig. 19.

Valve linear-lanceolate, constricted and rostrate-capitate. Length, 0.072 mm; breadth, 0.005. Costae 7, striae 30, in 0.01 mm. Differs from the type in its constricted valve and the different number of costae.

NITZSCHEA VITREA Normann? Plate 13, fig. 20.

Nitzschia vitrea Normann, A. Scandur, Atlas Diatom. (1921) p. 334 (figs. 16, 17).

Valve lanceolate, attenuate, and subrostrate. Length, 0.015 mm, breadth, 0.006. Costae long, 8 in 0.01 mm. Striae 18 in 0.01 mm. The Nippon form differs from the type in its short valve. A fresh-water species.

NITZSCHEA ACCULARIS W. Smith var. *NIPPONICA* var. nov. Plate 13, fig. 21.

Valve lanceolate with long horns or beaks. Length, 0.051 to 0.068 mm; breadth, 0.002 to 0.0025. Valve hyaline without striae. Common in Kizaki Lake.

HANTZSCHEA AMPHIOCTYS (Ehr.) Grun. Plate 13, fig. 22.

Hantzschia amphioxys (Ehr.) Grun., Fr. Hustedt, Bacillar. (1930) 394, fig. 747.

Valve lanceolate, constricted at one side, convex from the other. Ends truncate, slightly curved. Length, 0.032 mm, breadth, 0.006. Costae 8 to 9, striae 18, in 0.01 mm. Common in Kizaki Lake.

HANTZSCHEA ELONGATA (Hantz.) Grun. Plate 6, fig. 3.

Hantzschia elongata (Hantz.) Grun., Fr. Hustedt, Bacillar. (1930) 395, fig. 751.

Valve linear-lanceolate, attenuate towards the ends. Length, 0.195 mm, breadth, 0.01. Costae 5, striae 15, in 0.01 mm. Not common in Kizaki Lake.

CYMATOPLEURA SOLEA (Breb.) W. Smith var. *GRACILIS* Grun. Plate 15, fig. 4.

Cymatopleura solea (Breb.) W. Smith var. *gracilis* Grun., Fr. Hustedt, Bacillar. (1930) 420.

Valve linear, constricted in the middle, panduriform, concate at both ends. Length, 0.127 to 0.13 mm; breadth, 0.018 to 0.019. Reported from Aokiko Lake, Nippon.

CYMATOPLEURA SOLEA (Breb.) W. Smith var. **REGULA** (Ehr.) Grun. Plate 15, fig. 7
Cymatopleura solea (Breb.) W. Smith var. *regula* (Ehr.) Grun., Fr. Hustedt, Bacillar. (1930) 426, fig. 823b.

Valve linear, not constricted. Length, 0.062 mm; breadth 0.001. Rare.

CYMATOPLEURA ELLIPTICA (Breb.) W. Smith. Plate 14, fig. 1.

Cymatopleura elliptica (Breb.) W. Smith, Fr. Hustedt, Bacillar (1930) 426, fig. 825.

Valve broad-elliptic, cuneate. Length, 0.111 to 0.15 mm, breadth, 0.05 to 0.052. Common in Kizaki Lake.

SERIRELLA BISERIATA Breb. Plate 14, fig. 12.

Serirella biseriata Breb., Fr. Hustedt, Bacillar (1930) 432 fig. 831

Valve lanceolate with acute ends. Costæ reaching the median line 2 in 0.01 mm. Long diameter, 0.142 mm; short diameter 0.024. Common. Known from Aokiko Lake.

SERIRELLA BISERIATA Breb. fo. **PICTATA** Meister.

Serirella biseriata Breb. fo. *punctata* Meister, Fr. Hustedt Bacillar (1930) 433.

A form covered with puncta. Long diameter, 0.17 mm; short diameter, 0.032. Costæ 2 in 0.01 mm. Not common. Reported from Europe.

SERIRELLA BISERIATA Breb. var. **NIPPONICA** var. nov. Plate 14, fig. 11

Valve elongate-lanceolate with acute ends. Costæ 2 to 3 in 0.01 mm. Long diameter, 0.2 to 0.23 mm, short diameter, 0.028 to 0.03. Differs from the type in its longer valve. *Serirella Engleri* O. Mull. var. *harkensis* Skvortzow² seems to be related to the above species. Common in Kizaki Lake.

SERIRELLA BISERIATA Breb. var. **NIPPONICA** fo. **PICTATA** fo. nov. Plate 14, fig. 3

Valve punctate. Long diameter, 0.25 mm, short diameter, 0.027. Costæ 2 in 0.01 mm. Not common.

SERIRELLA BISERIATA Breb. var. **CONSTRICTA** Grun. fo. **PICTATA** fo. nov. Plate 14, fig. 14.

Valve constricted, acute and punctate. Median line linear. Long diameter, 0.12 mm; short diameter, 0.022. Known from Europe.

² *Dissert. of Hanka Lake* (1929) 37, pl. 8, fig. 3.

SURIRELLA BISERIATA Bosc. var. *BIFRONS* (Ehr.) Bosc. *Sp. BISERIATA* fo. *var.* *BIFRONS* Plate 16, fig. 2.

Valve short elliptic with acute ends, irregularly covered with horns. Long diameter, 0.102 mm; short diameter, 0.047. The variety *bifrons* was reported from Aokiko Lake.

SURIRELLA MORISETA Ehr. fo. *LATA* Bosc. Plate 16, fig. 3.

Surirella robusta Ehr. fo. *lata* HUSTEDT, Bacillar. aus dem Aokikosee in Japan 170, fig. 1.

Valve ovate with one end much broader than the other. Costae short, 1.5 to 2 in 0.01 mm, not reaching the pseudoraphe. Marginal keel forming wings in the middle part of the costae. Pseudoraphe lanceolate. Polar areas large. Long diameter, 0.072 mm; short diameter, 0.03. Reported only from Nippon. Common in Kizaki Lake.

SURIRELLA MORISETA Ehr. var. *SPLENDIDA* (Ehr.) Van Heurck. Plate 16, fig. 4.

Surirella robusta Ehr. var. *splendida* (Ehr.) Van Heurck, Fa. Illus. Trop. Bacillar. (1930) 437, figs. 861-862.

Valve narrow ovate, rounded at one end and acute at the other. Costae not reaching the median area. Long diameter, 0.093 to 0.136 mm; short diameter, 0.025 to 0.047. Common. Reported from Aokiko Lake.

SURIRELLA MORISETA Ehr. var. *SPLENDIDA* (Ehr.) Van Heurck fo. *HUSTEDTIANA* (Mayer) Hustedt.

Surirella robusta Ehr. var. *splendida* (Ehr.) Van Heurck fo. *Hustedtiana* (Mayer) Hustedt, Bacillar. (1930) 438.

Valve elliptic-lanceolate with acute ends. Costae not reaching the median area, parallel in the middle, radiate at the ends. Long diameter, 0.115 mm, short diameter, 0.037. Costae 2 in 0.01 mm. Known from Europe.

SURIRELLA MORISETA Ehr. var. *SPLENDIDA* (Ehr.) Van Heurck fo. *PUNCTATA* Bosc. Plate 16, fig. 5.

Surirella robusta Ehr. var. *splendida* (Ehr.) Van Heurck fo. *punctata* Hustedt Bacillar. (1930) 437.

Valve with attenuate, rounded ends. Punctate between the costae. Long diameter, 0.111 mm, short diameter, 0.037. Costae 1 to 1.5 in 0.01 mm. Known from Europe.

SARIRELLA ROBUSTA Ehr. var. *SPLENDIDA* (Cle.) Van Heurck fo. *CONSTRICTA* Hustedt. Plate 16, fig. 1.

Sarirella robusta Ehr. var. *spiculata* (Ehr.) Van Heurck fo. *constricta* Hustedt, Bacillar. (1930) 437.

Valve constricted. Long diameter, 0.153 mm; short diameter, 0.037. Rare.

SARIRELLA LINEARIS W. Smith. Plate 16, fig. 11.

Sarirella linearis W. Smith, Fr. Hustedt, Bacillar. (1930) 434, fig. 837.

Valve linear with cuneate ends. Alae and costae distinct. Median line linear. Long diameter, 0.042 mm; short diameter 0.01. Costae 2 in 0.01 mm. Reported from Aokiko Lake.

SARIRELLA LINEARIS W. Smith var. *CONSTRICTA* Grun. Plate 14, fig. 7.

Sarirella linearis W. Smith var. *constricta* (Ehr.) Grun., Fr. Hustedt Bacillar. (1930) 434, fig. 839.

Valve constricted. Long diameter, 0.072 mm; short diameter 0.013. Costae 2 in 0.01 mm. Found in Aokiko Lake, Nippon.

SARIRELLA LINEARIS W. Smith var. *HELVETICA* (Brum.) Meister. Plate 16, fig. 5.

Sarirella linearis W. Smith var. *helvetica* (Brum.) Meister, Fr. Hustedt, Bacillar. (1930) 434, fig. 840.

Valve linear with parallel margins, cuneate and punctate. Long diameter, 0.119 mm; short diameter, 0.034. Costae 1.5 in 0.01 mm. Also reported from Aokiko Lake, Nippon.

SARIRELLA LINEARIS W. Smith var. *NIPPONICA* var. nov. Plate 16, fig. 9.

Valve linear with subcuneate ends, punctate. Outer rim robust. Marginal keel or alae distinct. Costae parallel, 2.5 to 3 in 0.01 mm. Median line linear. Long diameter, 0.052 mm, short diameter, 0.014. Variety *nipponica* is closely connected with variety *helvetica*.

SARIRELLA LINEARIS W. Smith var. *NIPPONICA* fo. *CONSTRICTA* fo. nov. Plate 16, fig. 8.

Valve constricted with attenuate and cuneate ends, punctate. Median line linear. Long diameter, 0.064 mm; short diameter 0.01 to 0.012. Costae 3 in 0.01 mm. Not common.

SARIRELLA LINEARIS W. Smith var. *APICULATA* var. nov. Plate 16, fig. 3.

Valve linear, slightly constricted with subrostrate ends. Costae parallel, 3 in 0.01 mm, reaching the median line. Long diameter, 0.076 mm; short diameter, 0.014.

SURIRELLA CAPRONII Breh. var. ORTUZA Hustedt. Plate 14, fig. 5.

Surirella Capronii Breh. var. *obtusa* Hustedt, Bacillar. a. d. Asakozee in Japan 170, fig. 2.

Valve elongate-ovate with one end much broader than the other. Ends obtuse. Outer rim robust. Area distinct and robust. Costa not reaching the median area. On both ends of the median area two opposite horns. Polar area distinct. Long diameter, 0.156 mm; short diameter, 0.047. Known only from Aokiko and Kizaki Lakes.

SURIRELLA CAPRONII Breh. var. ORTUZA Hustedt sp. CAPITATA sp. nov. Plate 15, fig. 4.

Valve slightly constricted, one end very broad. Alae and costae robust, 1 in 0.01 mm. Long diameter, 0.156 mm, short diameter, 0.031.

SURIRELLA ELEGANS Breh. sp. ELONGATA sp. nov. Plate 15, fig. 4.

Valve linear with one end much broader than the other. Costae parallel, radiate at the ends, not reaching the median line. Long diameter, 0.215 mm; short diameter, 0.014. Costae 2 in 0.01 mm. Differs from the type in its more elongate valves.

SURIRELLA TENERA Hustedt. Plate 15, fig. 10.

Surirella tenera Gregory, Fl. Hesmer Bacillae (1930) 438, fig. 863.

Valve elongate-ovate, rounded at one end and acute at the other. Outer rim narrow, smooth. Marginal area distinct. Costae reaching the pseudoraphe, parallel in the middle, radiate at the ends. Long diameter, 0.138 to 0.11 mm; short diameter, 0.035. Common in fresh water. Not common in Kizaki Lake.

SURIRELLA TENERA Gregory var. PUNCTATA var. nov. Plate 15, fig. 11.

Punctate between the costae. Long diameter, 0.136 mm; short diameter, 0.04. Uncommon.

SURIRELLA TENERA Gregory var. NEVADA A. Schmidt. Plate 14, fig. 12.

Surirella tenera Gregory var. *nevada* A. Schmidt, Fl. Hesmer, Bacillae. (1930) 439, figs. 854-855.

Differs from the type in the median line being ornamented with a horn. Long diameter, 0.114 mm; short diameter, 0.034. Costae 2 in 0.01 mm. Uncommon.

SURIRELLA TERRIGENA Ward. Plate 16, fig. 11.

Surirella Terrigene Ward, A. Schmidt, Atlas Diatom. (1912) pl. 280, figs. 7-8.

Valve linear with obtuse ends. margins parallel or slightly constricted in the middle. Outer rim narrow, finely crossbarred

Costae or ribs reaching the pseudoraphe, 3 in 0.01 mm, parallel in the middle, slightly radiate at the ends. Between the costae are fine, closely set, parallel lines. Common in Kizaki and Aokiko Lakes. Known from North and South America only. *Surirella Chochmaz Skvortzow*² is closely connected with *Surirella Terryana*.

SURIRELLA TERRYANA Ward var. **MINUTA** var. nov. Plate 18, fig. 24 Plate 19, fig. 13.

Valve linear with parallel margins or slightly constricted, with rounded or cuneate ends. Costae not reaching the pseudoraphe, 3 in 0.01 mm. Central area linear, extending the length of the valve. Long diameter, 0.037 to 0.04 mm; short diameter, 0.008 to 0.009. Striae indistinct. Common.

SURIRELLA TERRYANA Ward var. **NIIPPONICA** var. nov. Plate 19, fig. 1.

Valve linear, constricted, with cuneate long ends. Outer rim narrow, finely crossbarred. Costae or ribs 2 in 0.01 mm, slightly curved, reaching the pseudoraphe. Striae distinct. Long diameter, 0.124 to 0.13 mm; short diameter, in the middle part 0.014, at the ends 0.019. Uncommon.

SURIRELLA OVALIS Benth. var. **NIIPPONICA** var. nov. Plate 19, fig. 4.

Valve ovate with outer rim robust, crossbarred. Costae short, 2 in 0.01 mm, not reaching the median area. Between the costae are fine, closely set, parallel lines. Median area is bounded by a closely set row of transverse lines, 18 in 0.01 mm. Long diameter, 0.098 mm; short diameter, 0.042. Variety *niipponica* differs from the type in its set row of transverse lines around the median area. *Surirella ovalis* is known as a brackish-water diatom.

SURIRELLA ANGULATA Kutz. Plate 2, fig. 12.

Surirella angulata Kutz., PR. HUSTEDT, Bacillar. (1930, 435, figs. 844-845.

A minute species common in fresh water. Valve linear with cuneate ends. Costae reaching the pseudoraphe, about 6 in 0.01 mm, parallel in the middle, radiate at the ends. Long diameter, 0.034 mm; short diameter, 0.011.

SURIRELLA PANTOCZEKII Meister. Plate 6, fig. 6.

Surirella Pantoczekii MEISTER, Beiträge zur Bacillar. Japans (1914 230, pl. 8, figs. 14, 15.

Valve long-linear with panduriform rounded ends. Outer rim narrow, finely crossbarred. Costae thin, short, parallel in the

² Diatoms from Hanka Lake (1929) 40, pl. 8, fig. 20

middle, radiate at the ends with intercostal striae. Central area narrow. Long diameter, 0.102 to 0.108 mm; short diameter, in the middle part 0.01, at the ends 0.013. Five fine costae in 0.01 mm. Reported as occurring near Yokohama, Nippon. Known from Amur and Sungari Rivers, Manchuria. *Surirella tienmensis* Skvortzow, from Tientsin, northern China, and from Hanka Lake, Siberia, differs from *S. Pantoesekii* only in its obtuse ends and smaller size.

SURIBELLA NIPPONICA sp. nov. Plate II, fig. 17.

Valve lanceolate with attenuate ends. Costae short, radiate, about 2 in 0.01 mm. Striae distinct. Median area broad. Differs from *Surirella deficiensima* Lewis* in its broader valve and wider costae.

STENOPTEROBIA INTERMEDIA (Lewis) ST. BACHITA Fricke. Plate IV, fig. 18.

Stenopterochia intermedius (Lewis) In. subacuta Fricke, A. Schmidt, Atlas Diatom. (1912) pl. 284, fig. 6.

Valve sigmoid with inconspicuous alae. Length, 0.119 mm; breadth, 0.004. Striae 30 in 0.01 mm. Very rare. Known from Aokiko Lake (variety *capitata* Fontell.)

* A. Schmidt, Atlas Diatom. (1906) pl. 266, fig. 6.

ILLUSTRATIONS

PLATE 1

FIG. 1 *Metosira americana* Kütz
 2 *Metosira tuberculata* Ehr. Kütz var. *Normani* Arnott
 FIGS 3 and 4 *Metosira Benderiana* Kütz
 F 5 *Metosira dilata* (Ehr.) Kütz subsp. *subarcata* var. O. Müll.
 6 *Metosira Italica* Ehr. Kütz var. *testacea* (Grun.) O. Müll.
 7 *Metosira dilata* (Ehr.) Kütz var. *arida* Grun.
 8 *Metosira granulata* (Ehr.) Ra. fa.
 9 *Fragilaria punctata* Ehr.
 10 *Metosira distans* Ehr. Kütz
 11 *Metosira dilata* (Ehr.) Cleve and Grun.
 12 *Cyclothea glomerata* Bachmann sp. *apponica* sp. nov.
 13 *Eutrema laevigata* (Lynch.) Heeberg var. *mesodora* (Ehr.) Grun.
 14 *Synedra laevispora* Kütz
 15 *Synedra Vaucheriae* Kütz var. *capillata* Grun.
 16 *Tavelaria flocculosa* (Reich.) Kütz
 17 *Fragilaria constellata* (Ehr.) Grun. var. *bimodus* Ehr. Grun.
 18 *Fragilaria a bimodata* Grun. var. *multata* (Hust.) Hust. sp. nov.
 19 *Meridion circulare* Agardh.
 20 *Synedra compacta* Kütz var. *apponica* sp. nov.
 21 *Fragilaria leptocephala* (Lynch.) Heeberg
 22 *Synedra microstoma* V. Sambu
 23 *Fragilaria leptocephala* (Lynch.) Heeberg
 24 *Eutrema laevigata* (Lynch.) Heeberg
 25 *Eutrema paradoxa* Grun.
 26 *Fragilaria rotundata* Kütz
 27 *Synedra leptostoma* Meister
 FIGS 28 and 29 *Fragilaria constellata* Ehr. Grun.
 F 30 *Eutrema perfoliata* (Kütz) Rabh. var. *apponica* (Kütz) Rabh.
 31 *Eutrema perfoliata* (Kütz) O. Müll. var. *apponica* var. nov.
 32 *Eutrema perfoliata* (Kütz) Rabh. var. *apponica* var. nov.
 FIGS 33 and 34 *Asterionella quadrivalvis* (Hantzsch) L. C. M. Geer.
 35 *Tauzia ramosa* (Lynch.) Kütz
 36 *Synedra lata* (Nitzsch) Ehr.
 37 *Synedra lata* (Nitzsch) Ehr. var. *leavesii* Herib. and Perag. Hust.
 38 *Eutrema aplanata* Kütz var. *platyteria* Meister
 39 *Synedra lata* (Nitzsch) Ehr. var. *biceps* (Kütz)
 40 *Eutrema granulata* (Ehr.) Rabh.
 41 *Eutrema tubata* Hust.
 42 *Synedra laevispora* Kütz var. *sigmoides* var. nov.
 43 *Synedra leptostoma* sp. nov.
 44 *Eutrema granulata* (Ehr.) Grun.

PLATE 2

FIG. 1. *Diploneis Sordida* (Breb.) Cleve var. *nippensis* var. nov.
 2. *Diploneis paello* (Schum.) Cleve
 3. *Diploneis elliptica* (Kütz.) Cleve var. *Indogensis* Cleve
 4. *Diploneis ocellata* (Breb.) Cleve
 5. *Cocconea plicatula* (Ehr.) var. *Intata* (Ehr.) Cleve
 6. *Diploneis elliptica* (Kütz.) Cleve var. *Indogensis* Cleve
 7. *Navicula concreta* Kütz. fo. *supercata* fo. nov
 8. *Cocconea plicatula* (Ehr.) var. *Minigrapha* Geijer fo. *supercata*
 fo. nov
 9. *Diploneis Smithii* (Breb.) Cleve var. *nippensis* var. nov
 10. *Achnanthes Petragalli* Brun and Herib. var. *nippensis* var. nov
 FIGS. 11 and 12. *Achnanthes lanceolata* Breb.
 FIG. 13. *Navicula atowensis* sp. nov.
 14. *Achnanthes Petragalli* Brun and Herib. var. *nippensis* var. nov
 15. *Achnanthes microstoma* Kütz
 FIGS. 16 to 18. *Cocconea distinata* Pant. ?
 FIG. 19. *Achnanthes prunata* Hust. var. *nippensis* var. nov.
 20. *Achnanthes lanceolata* Breb. var. *restrata* Hust.
 21. *Achnanthes microstoma* Kütz var. *cryptocephala* Grun.
 22. *Achnanthes microstoma* Kütz.
 23. *Achnanthes microstoma* Kütz.
 24. *Achnanthes Clevei* Grun. var. *nippensis* var. nov
 25. *Achnanthes knuti* sp. nov
 26. *Diploneis oralis* (Hilse) Cleve var. *oblongella* (Naegeli) C. var
 27. *Opegrapha Martii* Herib.
 28. *Synedra Vaucheriae* Kütz var. *capitellata* Grun.
 29. *Achnanthes lanceolata* Breb. var. *elliptica* Cleve
 30. *Achnanthes Petragalli* Brun and Herib.
 FIGS. 31 and 32. *Achnanthes Oestrupii* (A. Cleve) Hust.
 FIG. 33. *Helosira sericea* C. A. Ag.
 34. *Diatomella hemale* (Lynch.) Leiberg
 35. *Navicula Pissana* Cleve var. *ornata* (Pantocsek) Skvortzow
 36. *Ceratoneis arcus* Kütz var. *cryptozys* (Rabb.)
 37. *Diploneis oralis* (Hilse) Cleve
 38. *Achnanthes exigua* Grun. var. *indica* Skv
 39. *Euconcentus flexilla* (Kütz.)

PLATE 3

FIG. 1. *Nerdia bidentata* (Lagerst.) Cleve var. *nippensis* var. nov.
 2. *Navicula Brachia* Hust. fo. *elongata* fo. nov.
 3. *Amphipatra pellucida* Kütz
 4. *Navicula dicerphala* (Ehr.) W. Smith.
 5. *Cymbella regularis* W. Smith.
 6. *Amphipatra pellucida* Kütz var. *recta* Kitton.
 7. *Cyrtosigma Kütz* (Grun.) Cleve
 8. *Synedra Ulna* (Nitzsch) Ehr
 9. *Calonix aitula* Ehr. var. *huetiana* Skv and Meyer
 10. *Navicula globalifera* Hust. var. *nippensis* var. nov
 11. *Stauroneis Smithii* Grun.

FIG. 12. *Amphora decipiens* (Baldes) A. S. var. *minor* Cleve.
 13. *Amphora perpustula* Grun.
 14. *Amphora ovalis* Kütz. var. *pediculus* Kütz.
 15. *Amphora angustata* Kütz.
 16. *Amphora ovalis* Kütz. fo. *gracilis* Ehr. var. Cleve.
 17. *Amphora ovalis* Kütz. var. *hypoxylon* (Ehr.) Cleve.
 18. *Amphora Normannii* Rabh.
 19. *Pseudotaria mesoleptis* Ehr. var. W. Smith.
 20. *Cymbella striata* (Hemp.) Grun.
 21. *Stauroneis plantae* Ehr. fo. *nipponica* fo. nov.
 22. *Synedra acus* Kütz. var. *Meneghiniana* Grun.
 23. *Navicula capricornis* Ehr.

PLATE 4

FIG. 1. *Neldium italicocockei* Ehr.
 2. *Neldium productum* (W. Smith) Cleve fo. *constrictum* Hust.
 FIGS. 3 and 4. *Achmanthes granulata* Hust. var. *nipponica* var. nov.
 FIG. 5. *Neldium oblique-striatum* A. S. var. *nipponica* var. nov.
 6. *Neldium affine* (Ehr.) Cleve fo. *kerayrensis* (A. Mayer) Hust.
 7. *Ned. com. Lambda* C. ve var. *dein stratum* var. nov.
 8. *Neldium basileptatum* (Lagers.) Cleve var. *affine* var. nov.
 9. *Navicula ex grata* (Grev.) O. Muell.
 10. *Navicula papula* Kütz. var. *capitata* a. Hust.
 11. *Frustularia vulgaris* Thwaites.
 12. *Frustularia hemboldii* (Ehr.) de Toni. var. *saxonica* Rabh.
 Tun. fo. *cap. ova* A. Mayer.
 13. *Navicula adspersa* (Grun.) Cleve fo. *in not. Ko be*
 14. *Navicula a. mutans* Grun.
 15. *Navicula pseudosentiformis* Hust.
 16. *Neldium oblique-striatum* A. S. var. *rostrata* var. nov.
 17. *Ceratostria sphaerula* Ehr. Cleve var. *truncatula* Grun.
 18. *Frustularia rhomboidalis* (Ehr.) de Toni. var. *amplior* pro des. Grun.
 19. *Frustularia elongata* Ehr. (de Toni.)
 FIGS. 20 and 21. *Navicula pusilla* Cleve.
 FIG. 22. *Navicula oblique-striatum* A. S. var. *nipponica* var. nov.
 23. *Navicula confervicola* Kütz. fo. *nipponica* fo. nov.
 24. *Neldium oblique-striatum* A. S. var. *apertata* var. nov.
 25. *Navicula Rotmanni* (Rabh.) Grun.
 26. *Achmanthes pilularia* Hust. var. *japonica* Hust.
 27. *Stauroneis Smithii* Grun. var. *inversa* Pant.

PLATE 5

FIG. 1. *Navicula hastata* Pant.
 2. *Navicula rhynchocerata* Kütz.
 3. *Navicula rostellata* Kütz.
 4. *Navicula lanceolata* (Agardh) Kütz.
 5. *Navicula placorhiza* (Ehr.) Grun. fo. *rostrata* Mayer.
 6. *Navicula lacustris* Grev.
 7. *Navicula globuliformis* Hust.
 8. *Navicula radiata* Kütz.
 9. *Navicula fimbriae* Grun. var. *lanceolata* Grun.

FIG. 10. *Narcinia aqueducte* Krässke fo. *nipponica* Krässke.
 11. *Narcinia erinacea* (W. Smith) Donk. var. *capitata* var. nov.
 12. *Narcinia lapidosa* Krässke var. *nipponica* var. nov.
 13. *Narcinia similis* Krässke.
 14. *Stenoneis aenea* Ehr. var. *leptostoma* (Ehr.) Cleve
 15. *Stenoneis aenea* Ehr.
 16. *Narcinia menisculus* Schumann.
 17. *Narcinia lanceolata* (Agardh) Kütz. var. *synchroa* (Donk.) Cleve.
 18. *Narcinia anglica* Balfs.
 19. *Stenoneis phaeocystis* Ehr.
 20. *Stenoneis aenea* Ehr. fo. *procidea* (Ehr.) Cleve.
 21. *Narcinia solitaria* Grün. var. *nipponica* var. nov.
 22. *Narcinia testellata* Kütz. var. *nipponica* var. nov.
 23. *Cyphella hybrida* Grün.
 24. *Narcinia peregrina* (Ehr.) Kütz. var. *curvata* var. nov.

PLATE 6

FIG. 1. *Pinnularia platycephala* (Ehr.) Cleve.
 2. *Pinnularia platycephala* Cleve var. *Hattoriana* Meister.
 3. *Pinnularia karelii* Cleve var. *japonica* Hust. fo. *obtusa* fo. nov.
 4. *Pinnularia karelii* Cleve var. *japonica* Hust.
 5. *Pinnularia Bertholdiana* Griville.
 6. *Sutrella Pantoeviana* Meister.
 7. *Pinnularia macrostoma* (Ehr.) Cleve var. *lineolata* var. nov.
 8. *Pinnularia microstoma* (Ehr.) Cleve var. *nipponica* var. nov.
 9. *Achnanthes prociliata* Hust. var. *nipponica* var. nov.
 10. *Pinnularia major* (Kütz.) Cleve.
 11. *Pinnularia viridis* (Nitzsch) Ehr. var. *teplogangyla* (Ehr. Grun.) Cleve.
 12. *Pinnularia karelii* Cleve var. *lineolata* var. nov.
 13. *Pinnularia molaria* Grun.
 14. *Pinnularia viridis* (Nitzsch) Ehr. var. *nipponica* var. nov.
 15. *Narcinia falconensis* Grün. var. *nipponica* var. nov.
 16. *Narcinia euspidata* Kütz.

PLATE 7

FIG. 1. *Pinnularia Uvosa* sp. nov.
 FIGS. 2 and 3. *Pinnularia gibba* Ehr.
 FIG. 4. *Pinnularia legumen* Ehr. var. *nipponica* var. nov.
 5. *Pinnularia daebytus* Ehr. var. *Darriana* A. S. fo. *nipponica* fo. nov.
 6. *Pinnularia microstoma* (Ehr.) Cleve.
 FIGS. 7 and 8. *Achnanthes exigua* Grun. var. *nipponica* var. nov.
 FIG. 9. *Pinnularia viridis* (Nitzsch) Ehr. var. *intermedia* Cleve.
 10. *Pinnularia gibba* Ehr. var. *nipponica* var. nov.
 11. *Pinnularia major* (Kütz.) Cleve var. *lineolata* Cleve.
 12. *Pinnularia nipponica* sp. nov.
 13. *Pinnularia Oberholseri* sp. nov.
 14. *Narcinia cryptocapsula* Kütz. var. *veneta* (Kütz.) Grun.

FIG. 15 *Pinnularia gibba* Fhr. fo. *subundulata* Mayer
 16. *Achnanthos exigua* Grun.
 17. *Pinnularia borealis* Ehr.
 18. *Pinnularia microstauron* (Ehr.) Grun. var. *ambigua* Meister fo.
dumbifera Grun.

PLATE 8

FIG. 1 *Neidium nipponeum* sp. nov.
 2. *Brachysira viridis* (Nitzsch) Ehr. var. *nipponeum* var. nov.
 3. *Hantzschia elongata* (Hantz.) Grun.
 4. *Navicula pulicaria* sp. nov.
 5. *Pinnularia hastedtii* Meister.
 6. *Pinnularia leguminis* Ehr.
 7. *Rhopalodia parallela* (Grun.) O. Mull.
 8. *Achnanthos leucocoleta* Bréb. var. *rectirostra* Hust.
 9. *Navicula incisaria* Grig.
 10. *Eunotia tropica* Hust.
 11. *Actinella brasiliensis* Grun.
 12. *Rhopalodia gibberula* (Ehr.) O. Mull.
 13. *Cyclotella comata* (Ehr.) Kütz. fo. *partita* fo. nov.
 14. *Cyclotella meneghiniana* Kütz. var. *nipponea* var. nov.
 15. *Pinnularia leptosoma* Grun. var. *nipponea* var. nov.
 16. *Eunotia tronica* Hust.
 17. *Surirella nipponea* sp. nov.

PLATE 9

FIG. 1. *Diploneis Smithii* (Bréb.) Cleve var. *oblongella* var. nov.
 2. *Rhopalodia gibba* (Ehr.) O. Mull.
 3. *Caloneis ciliata* (Ehr.) Cleve var. *tumida* Hust. fo. *nipponea* fo. nov.
 4. *Stauroneis phantastica* Ehr. fo. *nipponea* fo. nov.
 5. *Pinnularia tabularia* Ehr.
 6. *Navicula perpusilla* Grun.
 7. *Pinnularia voidii* (Nitzsch) Ehr. var. *fallax* Cleve.
 8. *Navicula leptosoma* Grun.
 9. *Pinnularia montana* Hust. fo. *minor* fo. nov.
 10. *Pinnularia microstauron* (Ehr.) Cleve var. *nipponea* var. nov.
 11. *Rhopalodia parallela* (Grun.) O. Mull.
 12. *Epidictyon circulatum* (Ehr.) var. *leucostoma* Grun.
 13. *Ceratoneis arcuata* Kütz. var. *amphioxys* (Roth.)
 14. *Gyrosigma unicostatum* (Kütz.) Roth.
 15. *Fragilaria circinata* Ralfs.
 16. *Ceratoneis arcuata* Kütz. var. *amphioxys* (Roth.)
 17. *Cymbella strobila* Grig. var. *nitida* Grun.
 18. *Psammodia himata* (Lyngb.) Herberg var. *mesodora* (Lyngb.) Grun.
 19. *Cymbella obesa* (Ehr.) Cleve var. *longiora* (Ralfs.) L. sp.
 20. *Navicula amphibia* Cleve
 21. *Pinnularia viridis* (Nitzsch) Ehr. var. *undulata* (H. Sch.) Hust.

PLATE 10

FIG. 1 *Pinnularia nobilis* Ehr
 2 *Nauicula sphaeroides* (Ehr) var. *sphaeroides*
 3 *Nauicula cryptocerata* Kütz
 4. *Cymbella japonica* Reichert
 5 *Nauicula tenebrosa* (Aparah) Kütz
 6. *Velosira Bauderana* Kütz
 7. *Diatomella vulgaris* Bory var. *bogotensis* Grun
 8. *Gomphonema tenuicula* Ehr var. *incurvata* Kütz (Cleve)
 9. *Synedra japonica* Meissn.
 10. *Synedra I. un.* Nitzsch Ehr var. *divaricata* (Kütz) Grun
 11. *Gomphonema dasumii* Ehr. pr. *divaricata* var. nov
 12. *Velosira distans* (Ehr) Kütz var. *rotunda* Ehr + Böge
 13. *Diatomella humata* (Lyngb.) Hustedt
 14. *Cymbella Reinhardi* Grun
 15. *Flagellaria costata* (Ehr) Grun var. *appresseda* var. nov
 16. *Nauicula strobila* (Kütz) Grun var. *appresseda* var. nov
 17. *Achnanthes linearis* W. Smith var. *pusilla* Grun
 18. *Achnanthes tarecolae* (Brob.) var. *rostrata* Hustedt
 19. *Compsonea rotunda* Ehr var. *angusta* Schum.
 20. *Nitzchia nitida* (Ehr) Grun. fo. *nipponica* fo. nov
 21. *Eucypris virens* (Ehr) Kütz var. *saxorum* (Kütz) Grun.
 22. *Synedra Gouardii* (Brob.) Grun
 23. *Stauroneis Smithi* Grun var. *appresseda* pr. nov
 24. *Surirella Terryana* Ward fo. *minuta* fo. nov
 25. *Diatomella humata* Lyngb. Hustedt var. *angulosa* Ehr Grun
 26. *Parvularia levigata* Cleve
 27. *Achaearanea affinis* Grun. var. *minima* pr. nov
 28. *Meridion eudale* Agardh var. *co-striata* (Ralfs) Van Heege
 29. *Synedra rotula* Meister var. *appresseda* pr. nov
 30. *Stenopterobium ante medum* (Levist) fo. *subula* pr. nov Fricker
 31. *Gomphonema quadrivalvata* var. *Orstii* B. S. Gmelin var. *hastata* Wislouch.
 32. *Fragilaria constriata* Ehr. Grun. var. *adusta* Reichert
 33. *Cymbella pectata* (Berkeley) Cleve

PLATE 11

FIG. 1 *Cymbella japonica* Reichert
 2 *Cymbella tenua* W. Smith.
 3 *Cymbella Ehrenbergii* Kütz.
 4 *Cymbella heteropaucula* Ehr. var. *minor* Cleve
 5 *Cymbella gracilis* Kütz
 6 *Cymbella nasicula urmis* Averawald.
 7 *Cymbella japonica* Reichert
 8 *Cymbella ventricosa* Kütz.
 FIGS. 9 and 10. *Cymbella affinis* Kütz
 FIG. 11. *Nauicula matucana* Grun.
 12. *Achnanthes exilis* (Kütz) Cleve var. *appresseda* var. nov
 13. *Cymbella heteropaucula* Ehr. fo. *appresseda* fo. nov
 14. *Cymbella ventricosa* Kütz
 15. *Cymbella sinuata* Gregg.

14. *Cymbella tenuis* (Breb. Van Heurck) var. *borealis* Grun
 7. *Cymbella tenuis* Breb. Van Heurck
 8. *Cymbella ornata* Kütz.
 1. *Fragilaria consuta* Ehr. Grun var. *subtilis* Hostedt
 20. *Cymbella tenuissima* Greg. Cleve
 21. *Cymatia cymbiformis* (Agardh) Kütz. Van Heurck
 22. *Navicula Fusca* Cleve
 23. *Cymbella cespitosa* Kütz.
 14. *Cymbella tenuissima* Grun
 25. *Cymbella microcephala* Grun.

PLATE 12

1. *Pinnularia breviseta* Cleve
 2. *Cyclotella comta* Ehr. Kütz. var. *paucipunctata* Grun
 3. *Gomphonema nippense* sp. nov.
 4. *Gomphonema acrum notum* Ehr. var. *luteum* (Ehr.) Cleve
 5. *Gyrosigma scalpula* Kütz. + Cleve
 6. *Opephora Okadie* sp. nov.
 7. *Gomphonema laevigatum* Ehr. var. *laevigatum* Greg. + Cleve
 8. *Opephora Marinii* Herib. var. *robusta* var. nov.
 9. *Deptonella marginistrigata* Hust.
 10. *Nedunia dubia* (Ehr.) Cleve
 11. *Pinnularia mesolepta* (Ehr.) W. Smith
 12. *Cymbella spinosa* Grun.
 13. *Achnanthus intercalata* Breb. var. *nippense* var. nov.
 14. *Surirella tenera* Greg. var. *pyrenacea* var. nov.
 5. *Surirella punctata* Kütz.
 6. *Gomphonema Berggrenii* Cleve
 7. *Achnanthus Osteopus* (A. Cleve) Hust.
 8. *Pinnularia viridis* (Nitzsch.) Ehr. var. *lutea* Cleve
 9. *Nedunia Boulii* Mereisch. var. *nipponica* var. nov.
 20. *Fragilaria oblonga* Ralfs. var. *alpina* Hust. fo. *nipponica* fo. nov.
 11. *Fragilaria rotula* Ehr.
 12. *Cymbella gracilis* (Breb.) Cleve fo. *minor* fo. nov.
 13. *Microcoleus septentrionalis* Oestr.
 14. *Paratextularia divergensissima* Grun
 5. *Endeotria praesumpta* Ehr.
 26. *Achnanthus Hauckianus* Grun.

PLATE 13

1. *Nitzschia intercalata* Breb. Hust.
 2. *Nitzschia parva* K. + W. Smith var. *temeraria* Grun
 3. *Cypridina Marinii* Herib.
 4. *Spirula erosa* Breb. var. *repertula* var. nov.
 5. *Gomphonema costatum* Hust.
 6. and 5. *Gomphonema ligulatum* Hust.
 6. *Gomphonema acrum notum* Ehr. var. *coronata* Ehr. W. Smith
 9. *Gomphonema peronii* Kütz. + Grun var. *microspus* (Kutz.) Cleve
 10. *Opephora Marinii* Herib. var. *robusta* var. nov.

FIG. 11. *Hantzschia amphioxys* (Ehr.) Grun.
 12. *Opephora Martyni* Herib. var. *elongata* var. nov.
 13. *Gomphoceros constrictum* Ehr.
 14. *Gomphonema intricatum* Kütz.
 15. *Nitzschia evanescens* Rabb.
 16. *Gomphonema parallelogram* (Kütz.) Grun.
 FIGS. 17 and 18. *Nitzschia dissipata* (Kütz.) Grun.
 FIG. 19. *Nitzschia palea* (Kütz.) W. Smith.
 20. *Gomphoceros constrictum* Ehr.
 21. *Gomphoceros parallelogram* (Kütz.) Grun. var. *extensus* Grun.
 22. *Gomphoceros olivaceum* (Lyngb.) Kütz.
 23. *Gomphonema constrictum* Ehr. var. *capitata* (Ehr.) Cleve
 24. *Gomphonema nipponica* sp. nov.
 25. *Nitzschia recta* Hanckeh.
 26. *Nitzschia dissipata* (Kütz.) Grun.
 27. *Nitzschia aciculata* W. Smith var. *zippeliana* var. nov.
 28. *Nitzschia palea* (Kütz.) W. Smith.
 29. *Nitzschia villosa* Normann.
 30. *Nitzschia capitellata* Hust. var. *nipponica* var. nov.
 31. *Gomphonema angular* Ehr.
 32. *Gomphonema forceolatum* Ehr. var. *taeniatum* (Greg.) Cleve
 33. *Gomphonema tenuum* Hust. var. *elongata* var. nov.
 34. *Gomphonema parallelogram* (Kütz.) Grun.
 35. *Nitzschia fastigata* Grun.
 36. *Gomphoceros parallelogram* (Kütz.) Grun. var. *nipponicus* (Kütz.) Cleve sp. *nipponica* sp. nov.
 37. *Synecha cyclopaea* Brutschi var. *nipponica* var. nov.
 38. *Gomphoceros acuminatum* Ehr.
 39. *Gomphonema olivaceum* (Lyngb.) Kütz. var. *minutissimum* Hust.
 40. *Gomphoceros tenuum* Hust. var. *elongata* var. nov.
 41. *Gomphonema intricatum* Kütz.
 42. *Gomphonema oblongatum* Agardh* Kütz.

PLATE 14

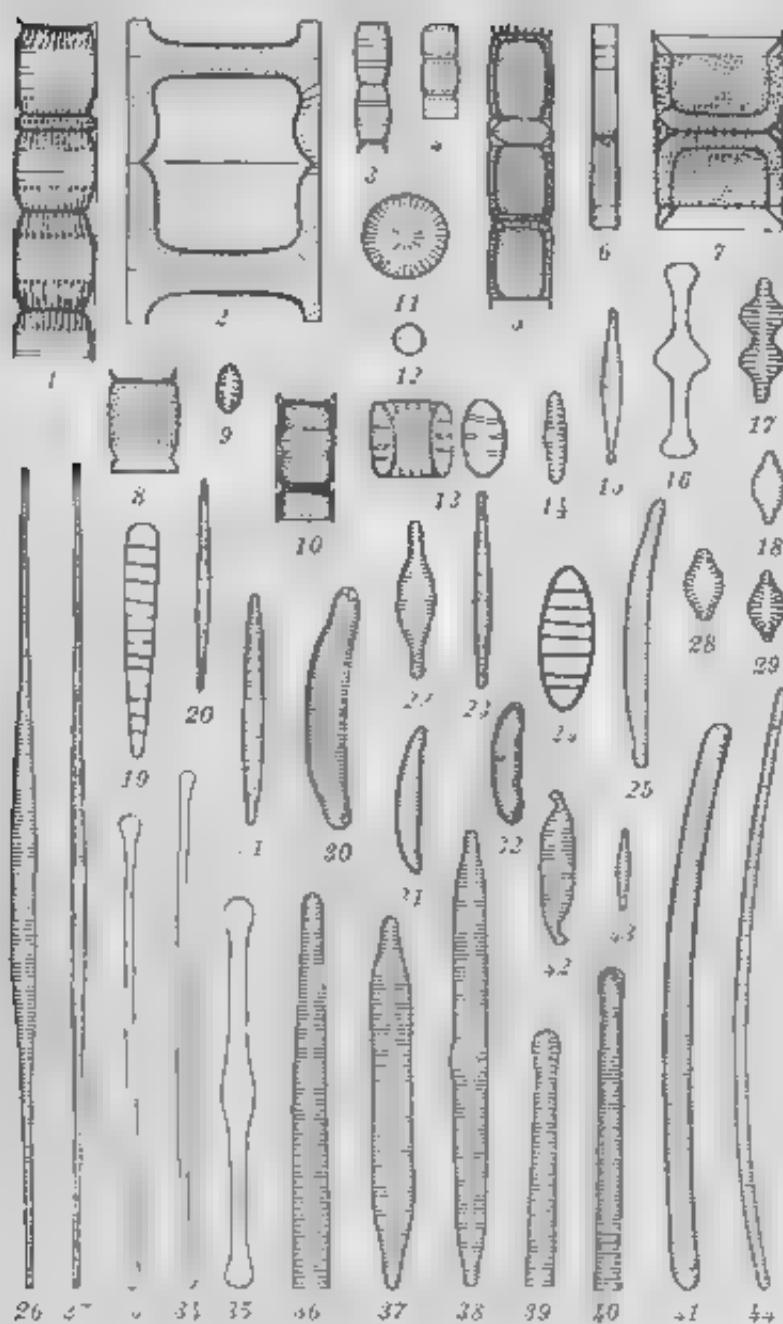
FIG. 1. *Cryptopleura elliptica* (Breb.) W. Smith.
 2. *Diplanthes oblonga* (Breb.) Cleve var. *nipponica* var. nov.
 3. *Sarirella robusta* Ehr. var. *splendida* (Ehr.) Van Heege.
 4. *Exocetia jaba* (Ehr.) Grun. var. *nipponica* var. nov.
 5. *Sarirella Capronii* Breb. var. *obtusa* Hust.
 6. *Ackmania Hauckiana* Grun. var. *elliptica* Schulz. sp. *nipponica* fo. nov.
 7. *Sarirella linearis* W. Smith var. *constricta* (Ehr.) Grun.
 8. *Fragilaria Harrissonii* W. Smith var. *rhomboides* Grun.
 9. *Fragilaria brevistriata* Grun.
 10. *Ensatia pectinaria* (Kütz.) Rabb. var. *minor* (Kütz.) Rabb. fo. *impressa* (Ehr.).
 11. *Sarirella lateralis* Breb. var. *nipponica* var. nov.
 12. *Sarirella biserrata* Breb.
 13. *Sarirella tenera* Greg.
 14. *Sarirella biserrata* Breb. var. *constricta* Grun. fo. *praeata* fo. nov.
 15. *Sarirella tenera* Greg. var. *terrea* A. Schmidt.

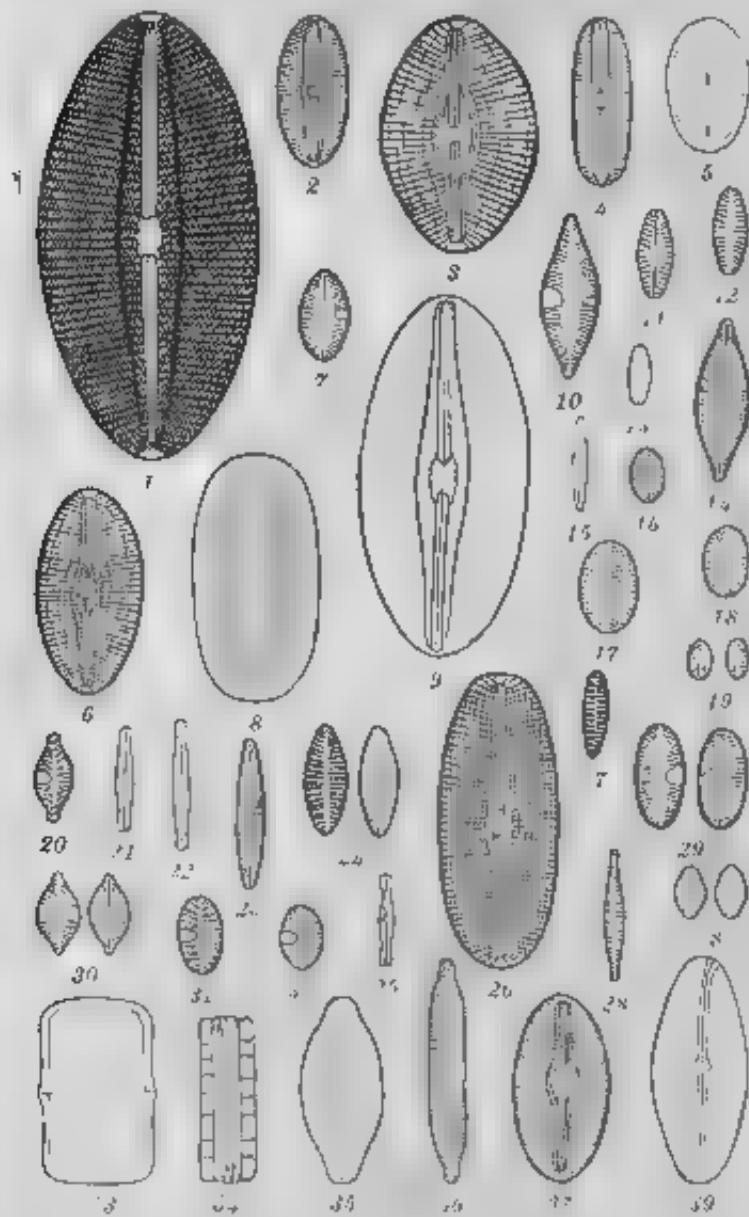
PLATE 15

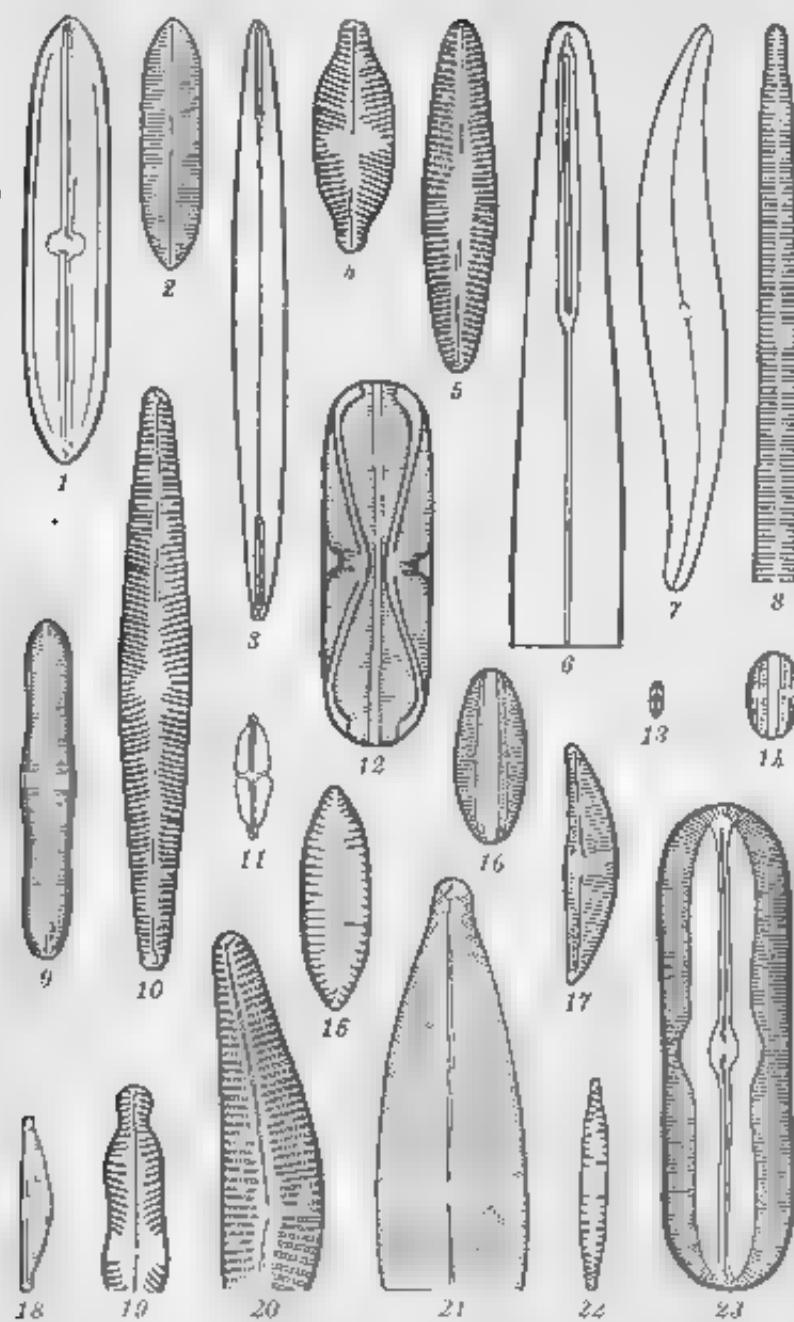
FIG. 1 *Surirella biserrata* Breb var *bifrons* (Ehr) Hust fo. *inspida* fo. nov
 2 *Surirella Terryana* Ward var *nipponica* var. nov
 3 *Surirella biserrata* Breb var *nipponica* fo. *punctata* fo. nov
 4 *Surirella elegans* Ehr fo. *congata* fo. nov
 5 *Auricula multica* Kutz
 6 *Cymatopeltia sotae* (Breb) W. Smith var *gracilis* Grun.
 7 *Cymatopeltia sotae* (Breb) W. Smith var *regina* (Ehr) Grun.
 8 *Surirella linearis* W. Smith var *nipponica* var. nov. fo. *constricta* fo. nov
 9 *Surirella linearis* W. Smith var *nipponica* var. nov
 10 *Cymbella Kawamurae* sp. nov
 11 *Surirella linearis* W. Smith
 12 *Epithemia sotae* Kutz
 13 *Surirella Terryana* Ward fo. *minuta* fo. nov

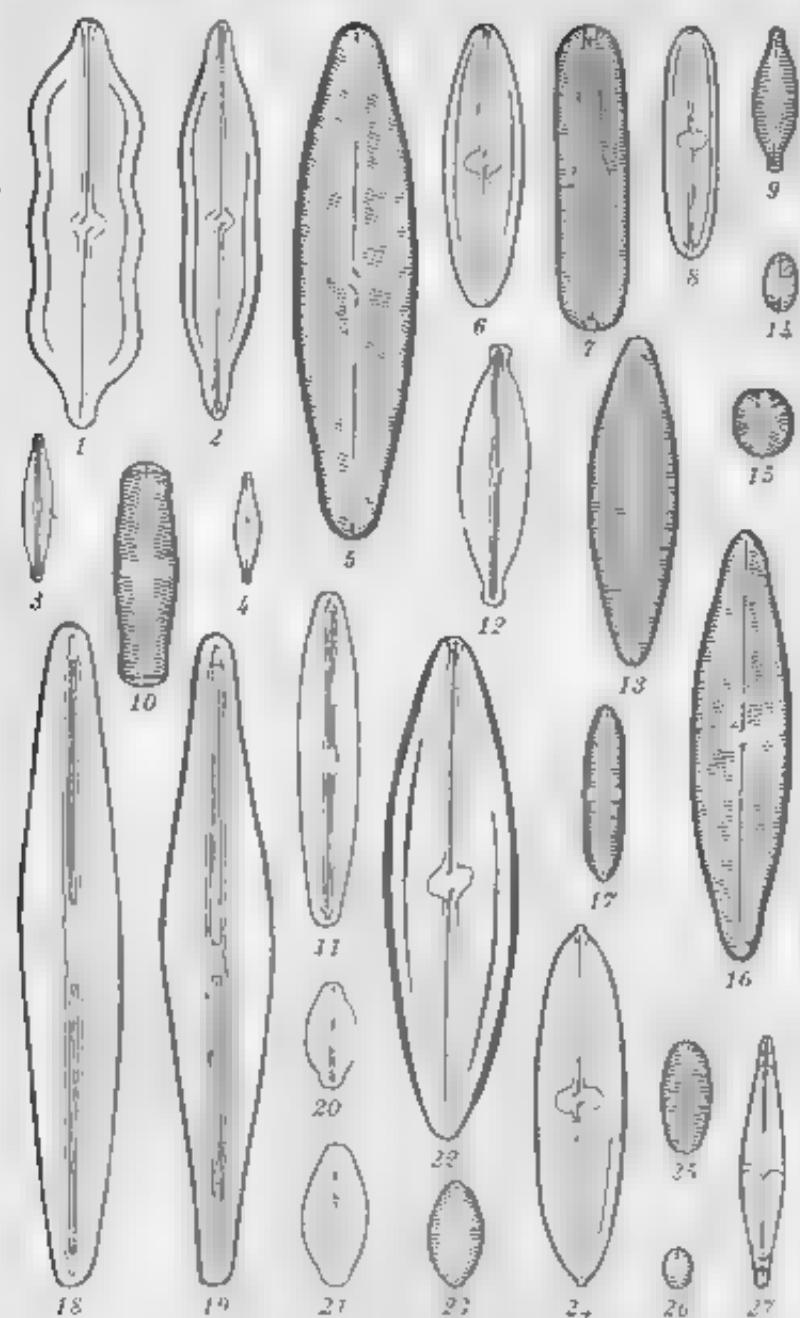
PLATE 16

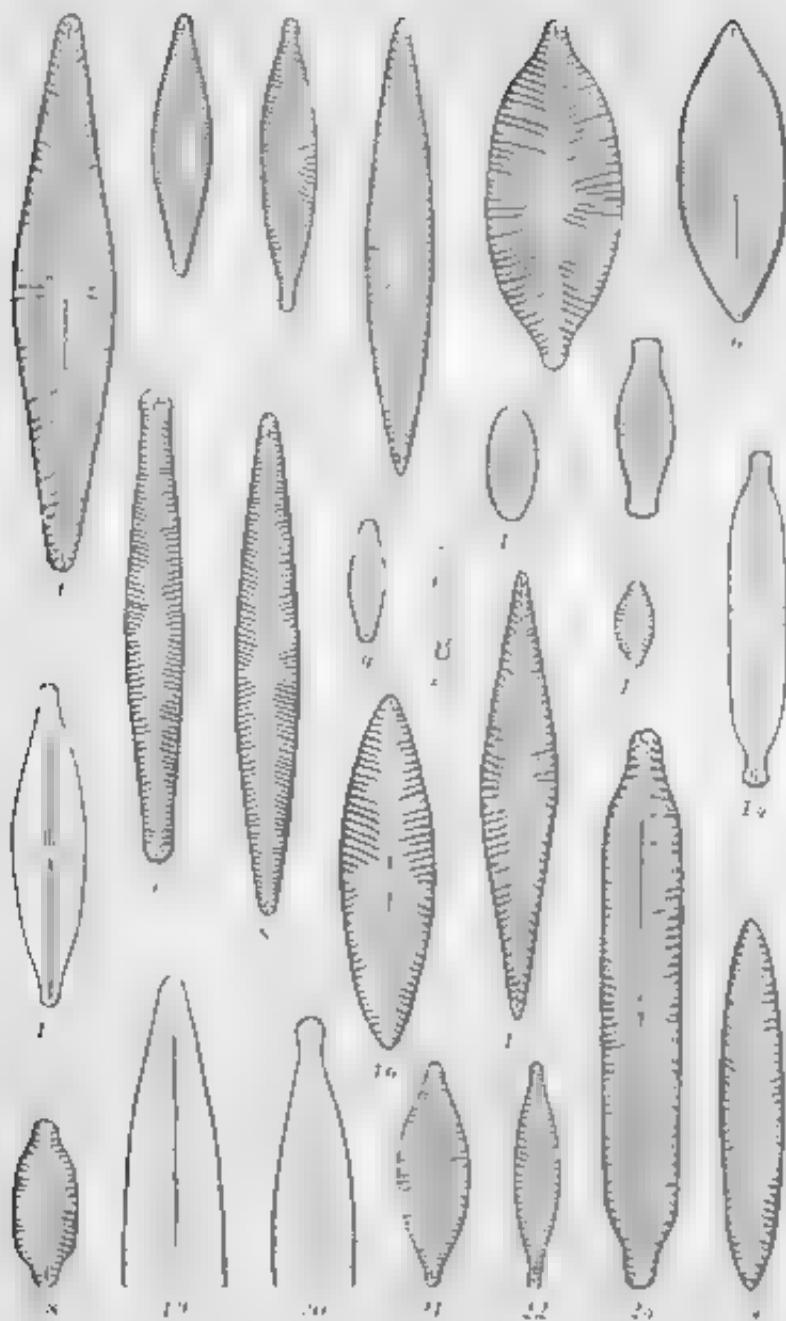
FIG. 1 *Surirella robusta* Ehr var *spendida* (Ehr) Van Heurck fo. *constricta* Hust
 2 *Surirella robusta* Ehr var *spendida* Ehr, Van Heurck fo. *punctata* Hust
 3 *Surirella linearis* W. Smith var *apiculata* var. nov
 4 *Surirella Capronii* Breb. var *obtusa* Hust fo. *capitata* fo. nov
 5 *Fragilaria Harrisonii* W. Smith
 6 *Fragilaria Harrisonii* W. Smith var. *disca* Grun.
Fragilaria brevistriata Grun. var *nipponica* var. nov.
 5 *Surirella linearis* W. Smith var *helvetica* Brum. Meissner
 9 *Fragilaria constricta* Ehr. Grun var *borealis* (Ehr) Grun
 10 *Surirella robusta* Ehr fo. *tota* Hust
 11 *Surirella Terryana* Ward
 12 *Auricula keeakiensis* sp. nov
 13 *Fragilaria construens* (Ehr) Grun var *nipponica* var. nov
 14 *Pinnularia Balfouriana* Grun var *strobliptera* var. nov
 15 *Pinnularia borealis* Ehr

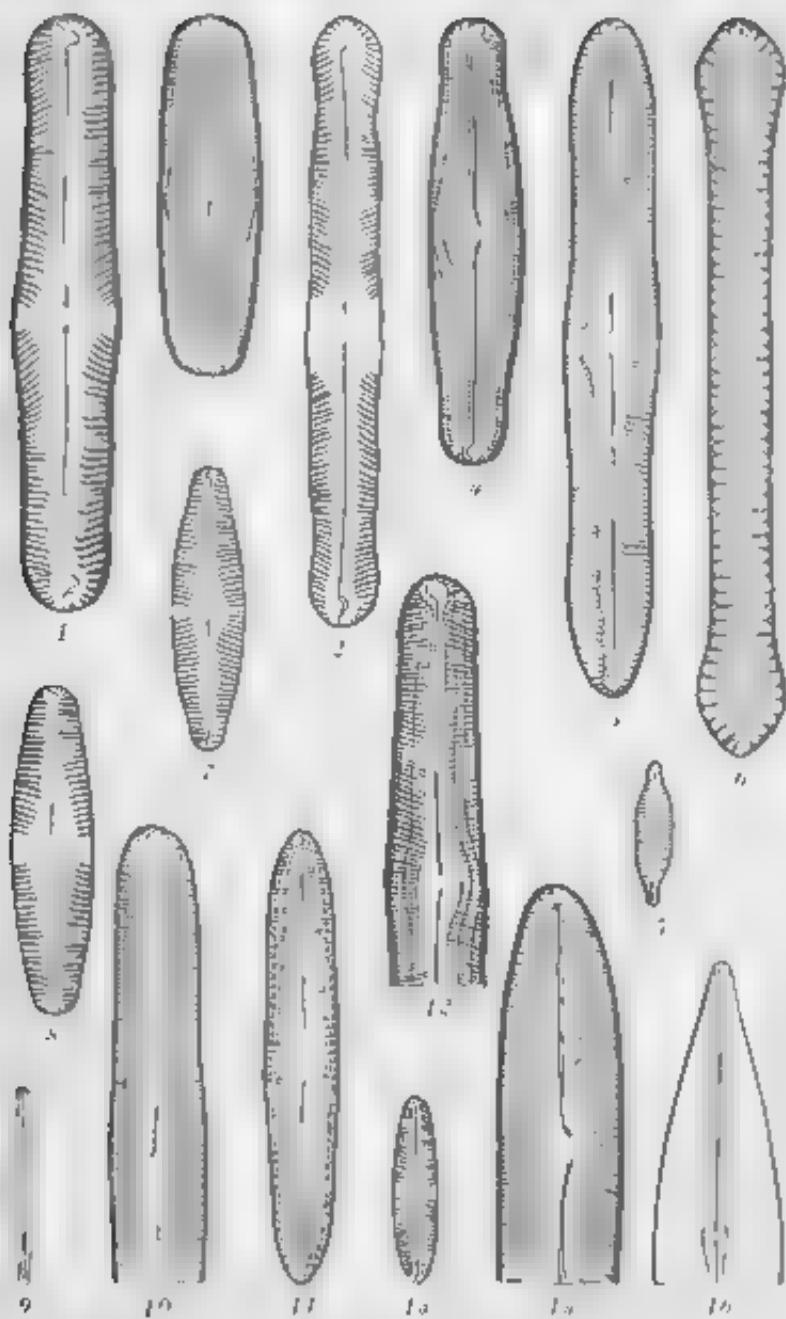


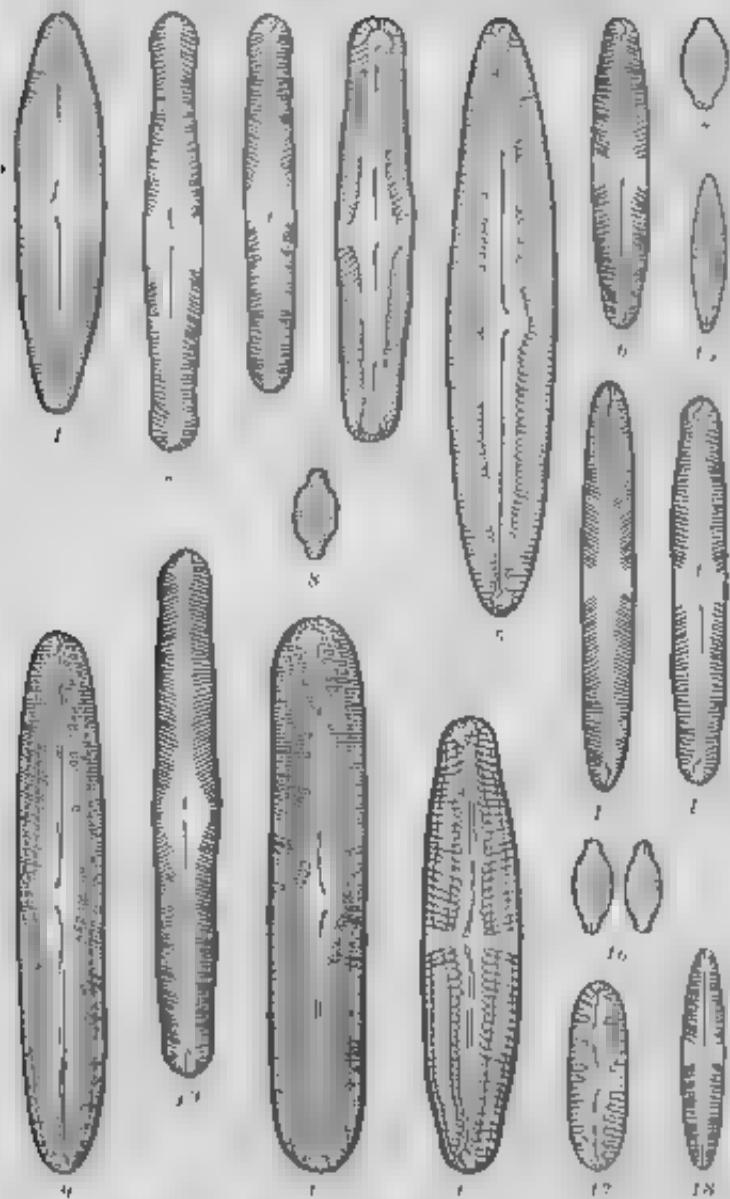












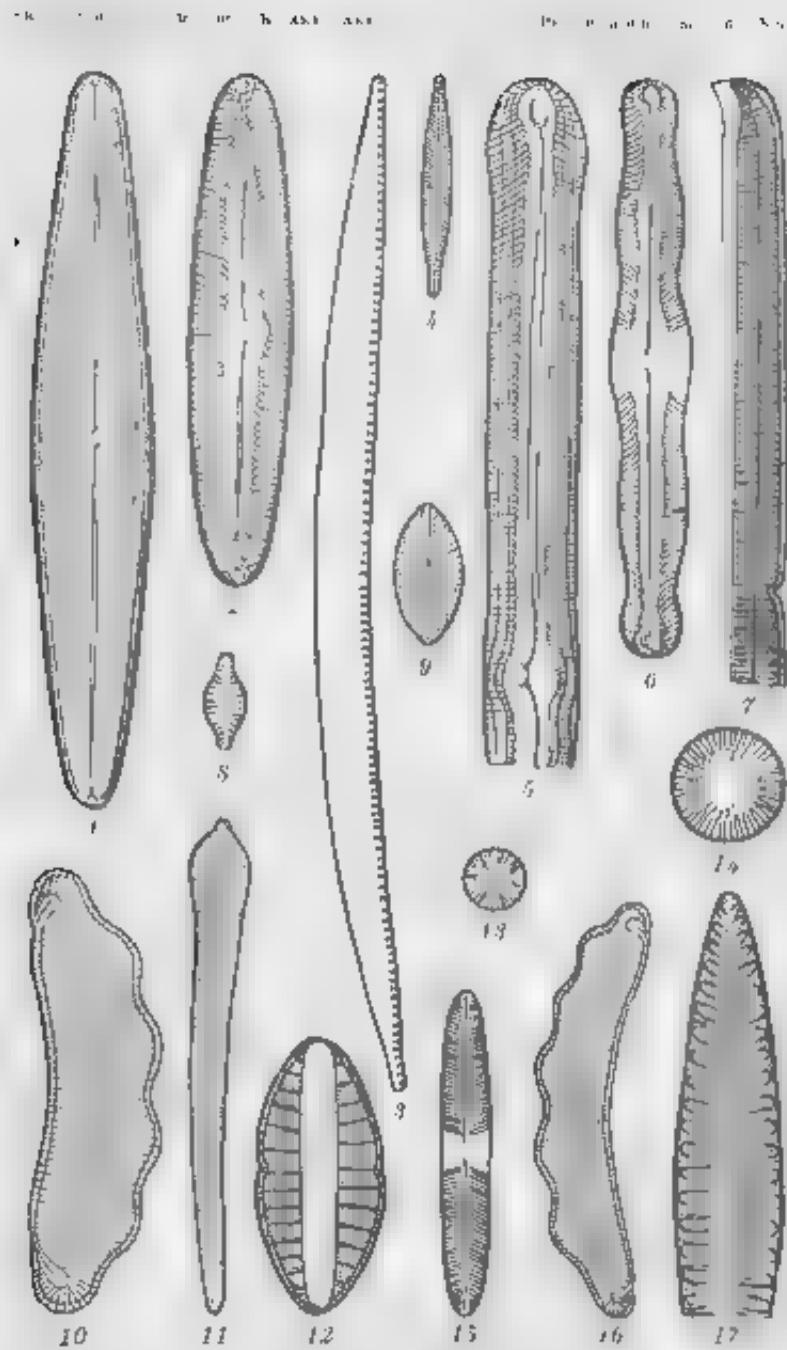


PLATE B

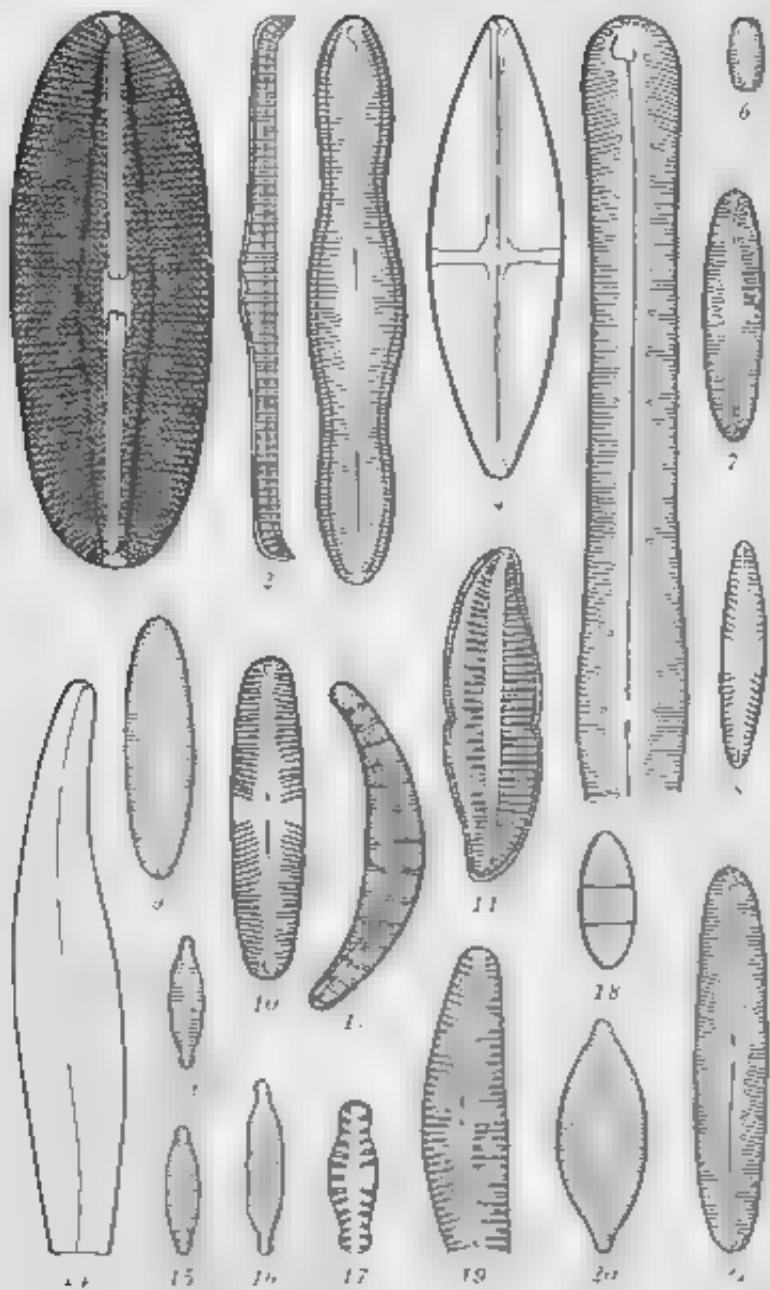
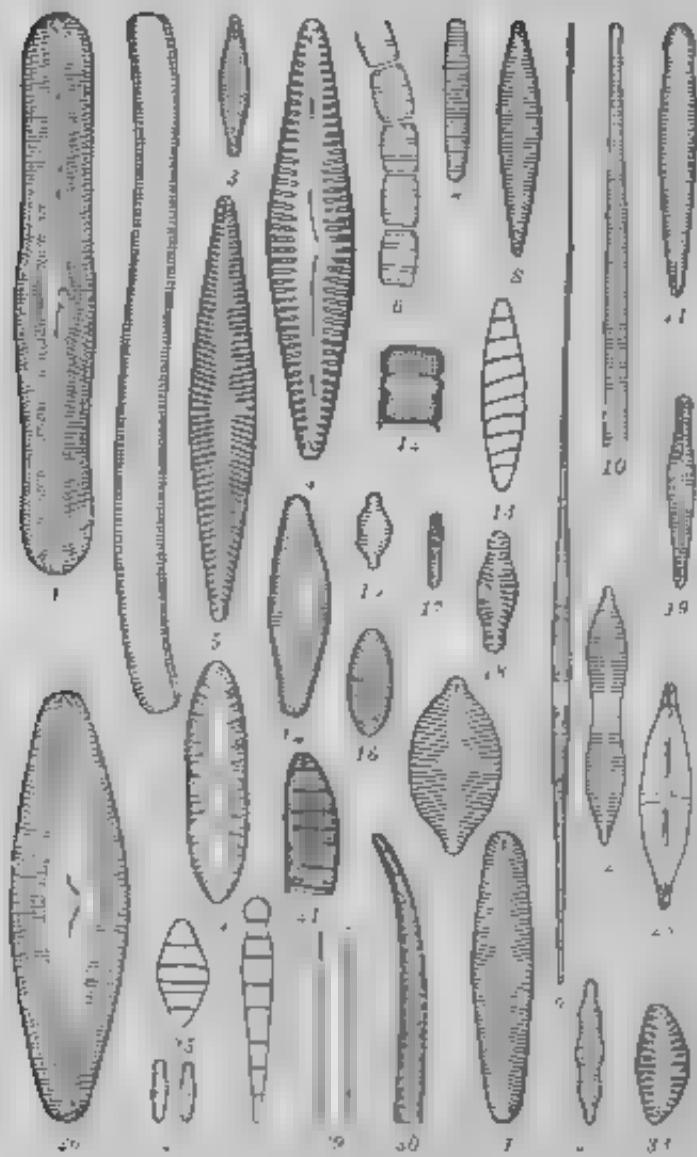
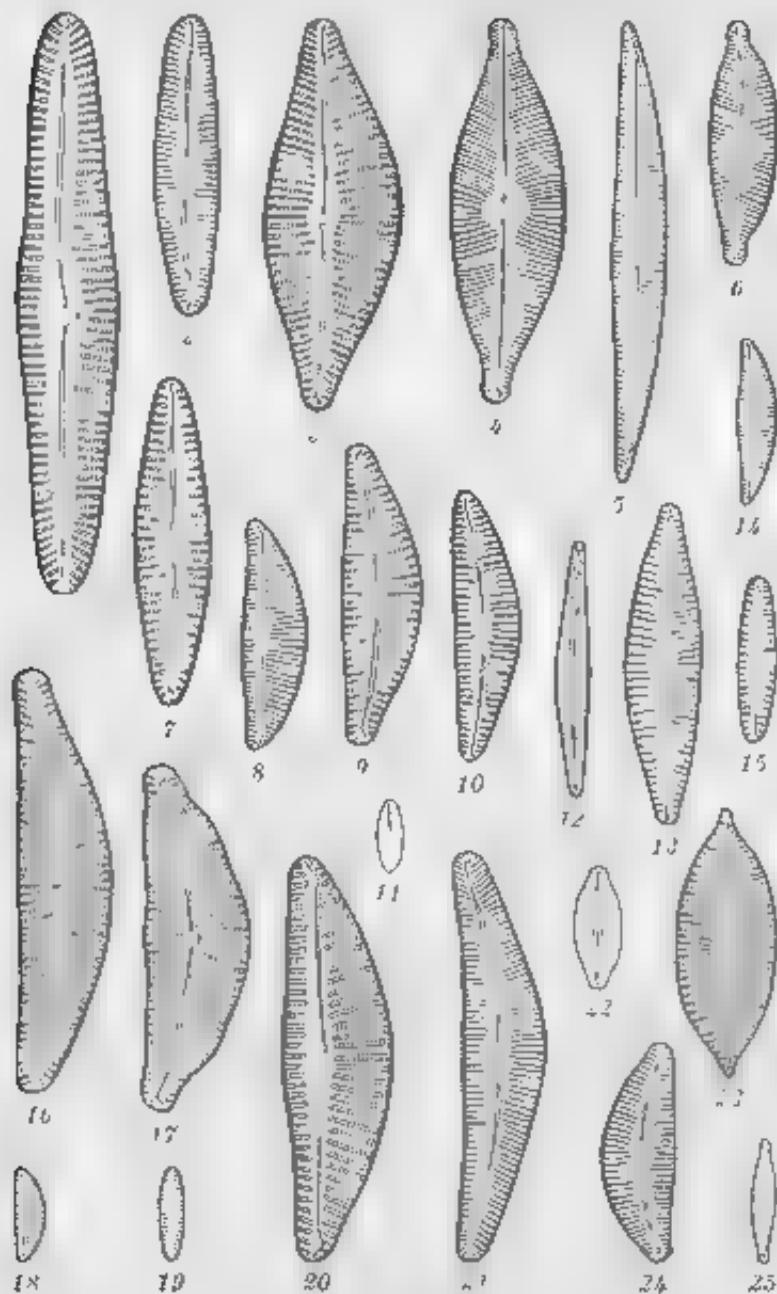


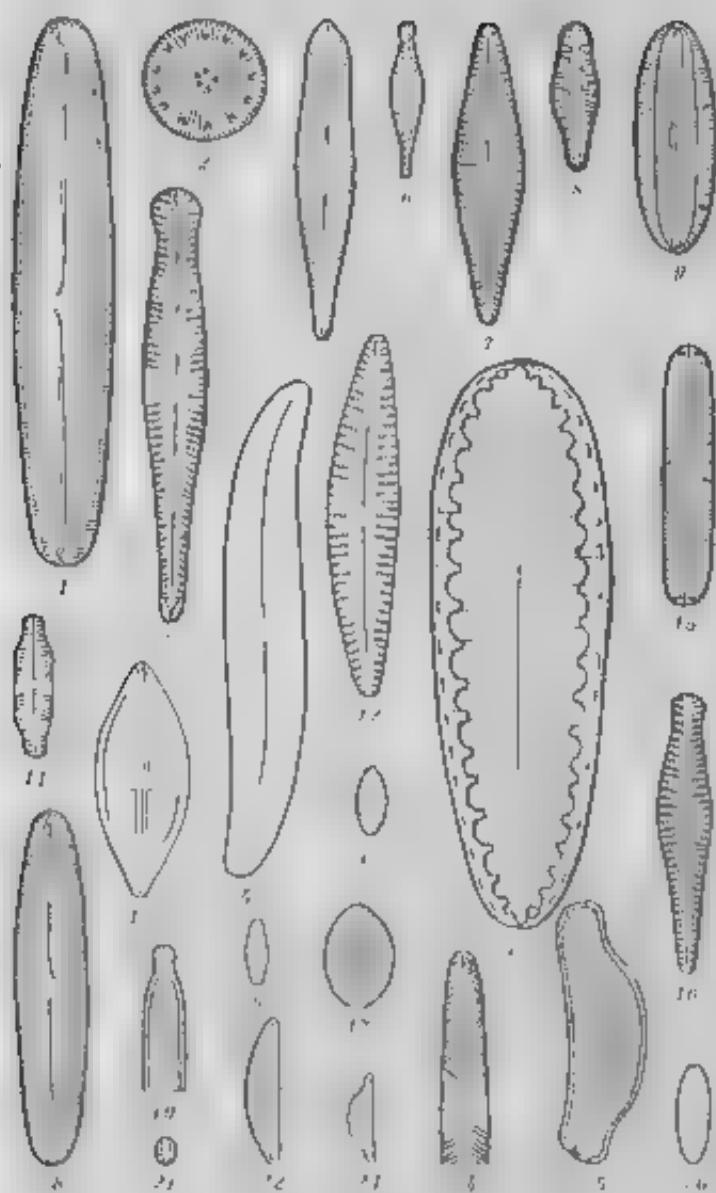
PLATE 3.



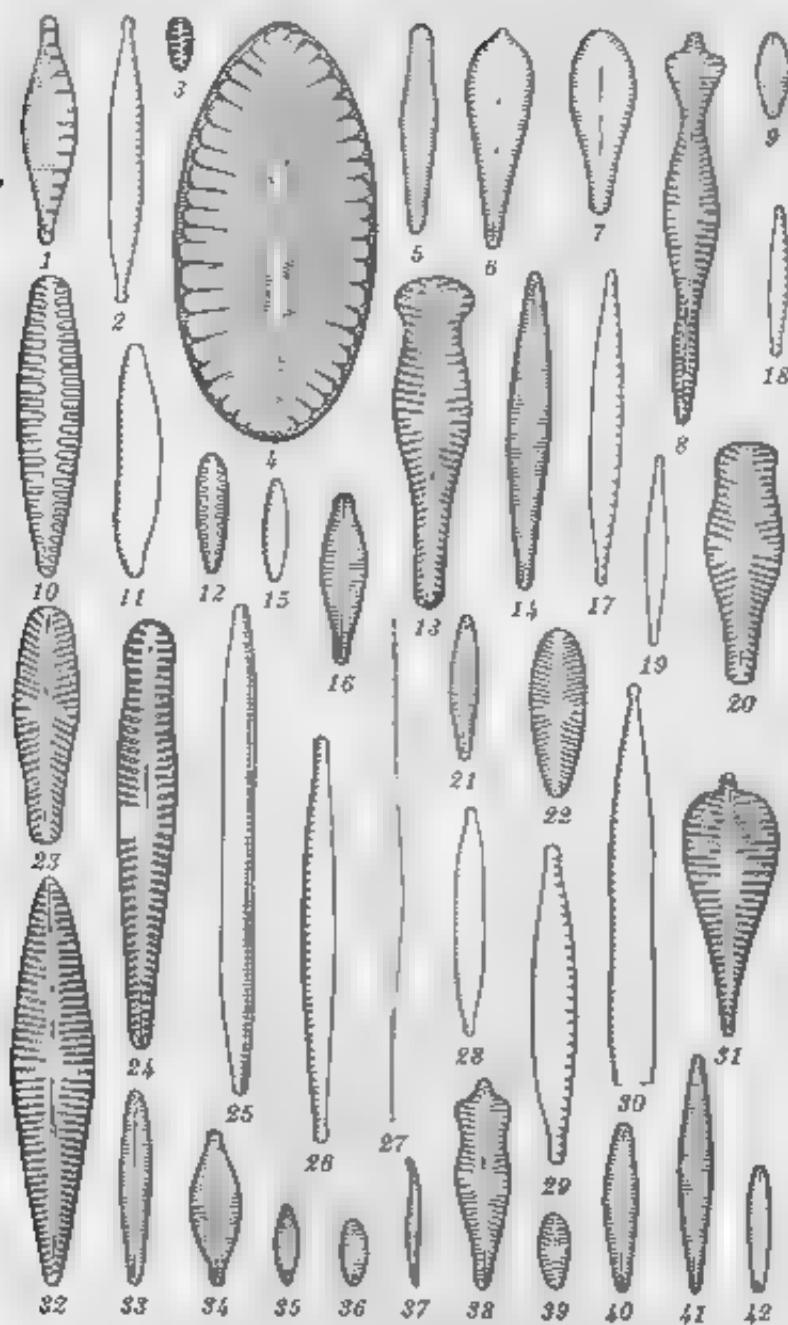


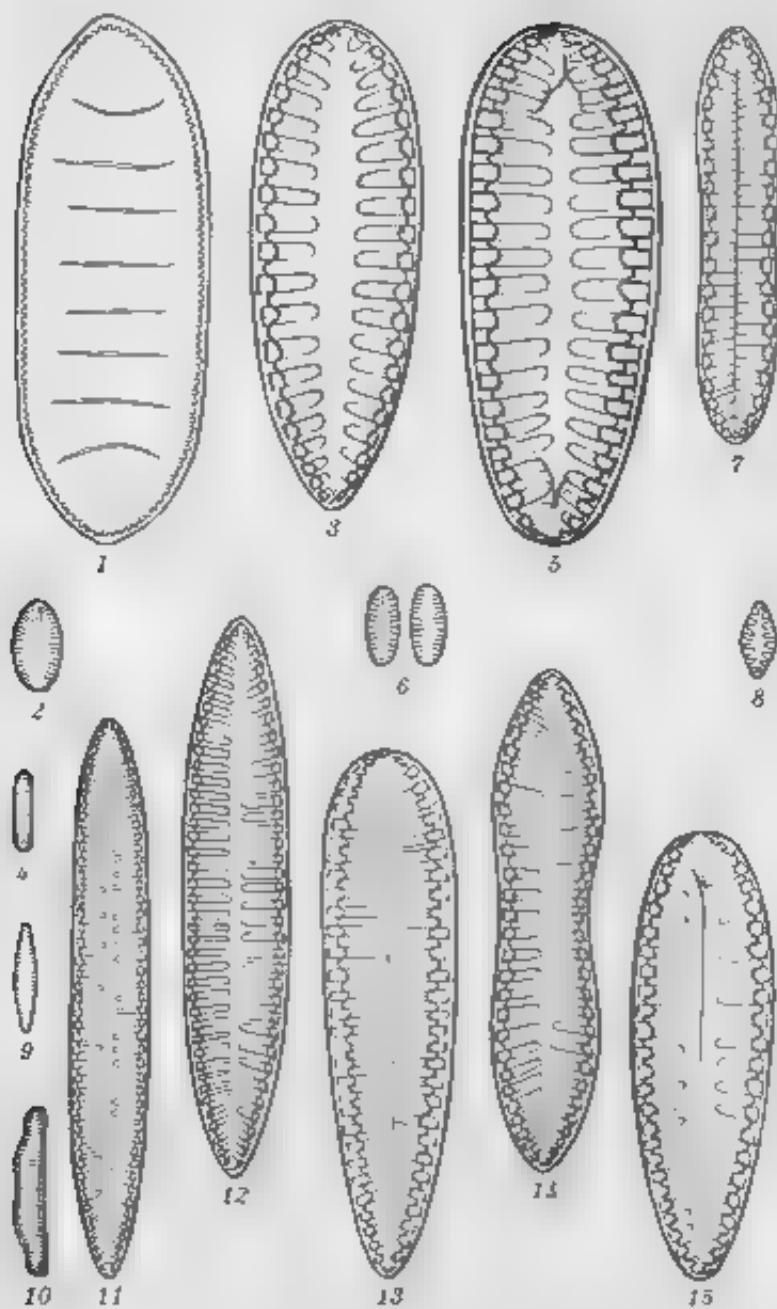
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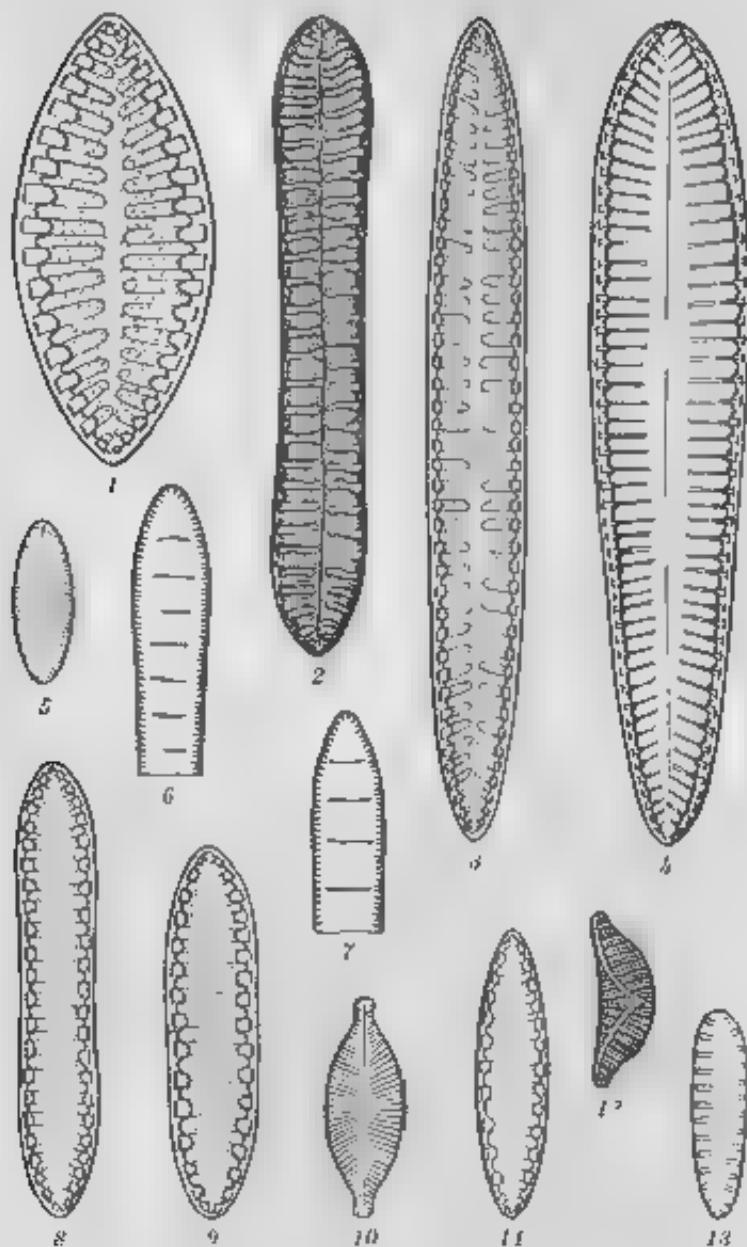
PLATE 01 02 03 04 05 06 07 08 09

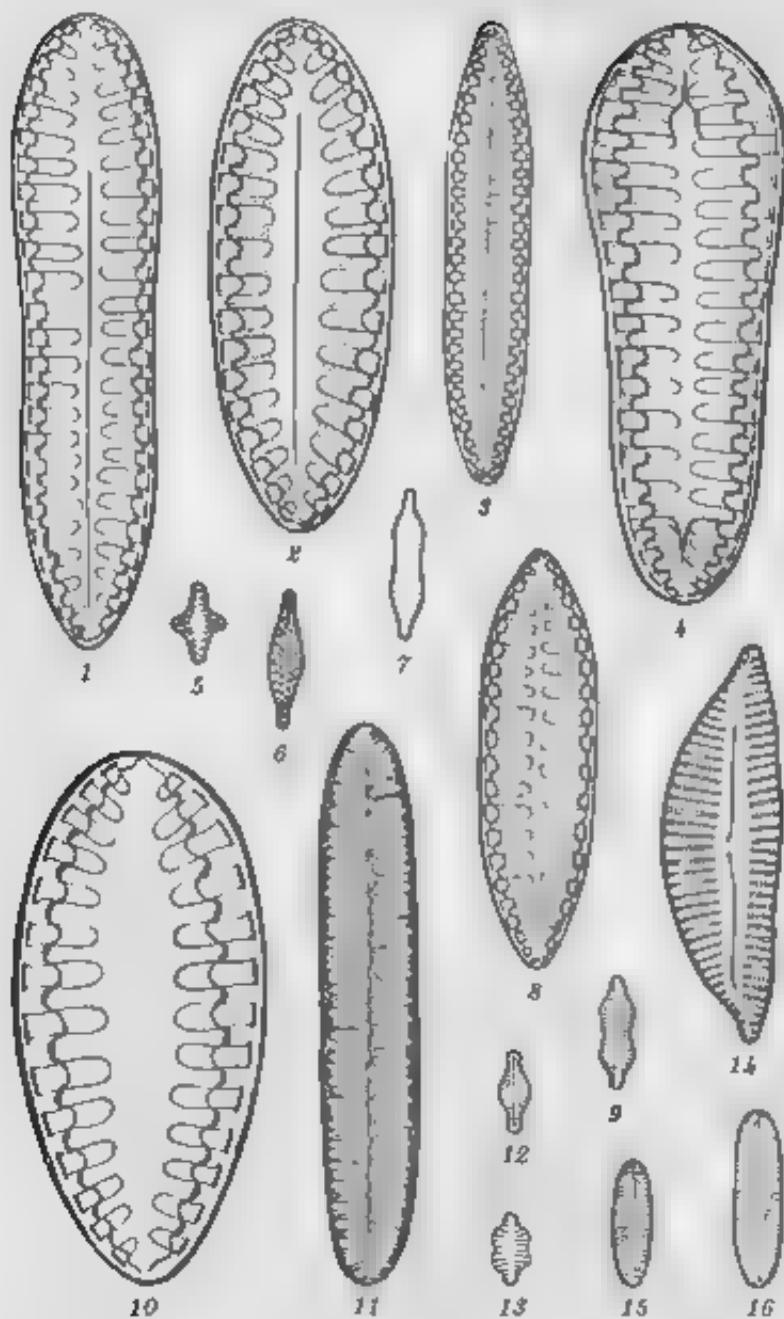


PLATE









OOCHEIRISTICA EXCELSA, A NEW REPTILIAN CESTODE

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ONE TEXT FIGURE

Two specimens of a new tapeworm were found in the intestine of a grass lizard, *Allobius undulatus*. Unfortunately, the head and neck are lacking in one of the specimens, for which reason a comparative study could not be made of these structures.

According to Meggitt (1934), the genus *Oocochiristica* (Luehe, 1898) includes twenty five valid species, the other forms that have been described under the genus being either synonymous or members of closely related cestode genera. To these the following have recently been added: *Oocochiristica sykesi*, described by Burt (1933) from a lizard, *Lycosoma punctatum*, caught in Colombo, Ceylon; *O. shapari*, described by John (1934) from an Indian lizard, *Calotes* sp. and *O. taborense* found by Loewen (1934) in the intestine of a bat in Kansas, United States. Compared with these known species and considering, according to Meggitt, the course of the genital ducts, the extent of the cirrus sac across the proctotilis, and the arrangement of the testes as important characters in differentiating between the members of the genus, the Philippine parasite appears to bear the closest resemblance to *O. curvinervosa* (Cohn, 1902), *O. fibra* Meggitt, 1927 and *O. americana* Hardwood, 1932. It may be distinguished, however, from these three species by the small or dimensions of its body, head, and cirrus pouch, its fewer testes, and the oval shape of the lobes of its ovary.

OOCHEIRISTICA EXCELSA sp. nov. (Text fig. 1)

Description. Maximum length about 26 millimeters. Immature and mature segments much wider than long, gravid segments narrower but usually much longer than wide. Extreme measurements of available material gave the following results: Immature segments 0.030 to 0.072 by 0.24 to 0.35, mature segments 0.095 to 0.247 by 0.38 to 0.62, gravid segments 1.9 to 4.7 by 0.55 to 1.1 millimeters. Scolex unarmed, 0.25 millimeter in diameter, separated from the rest of the worm by a very

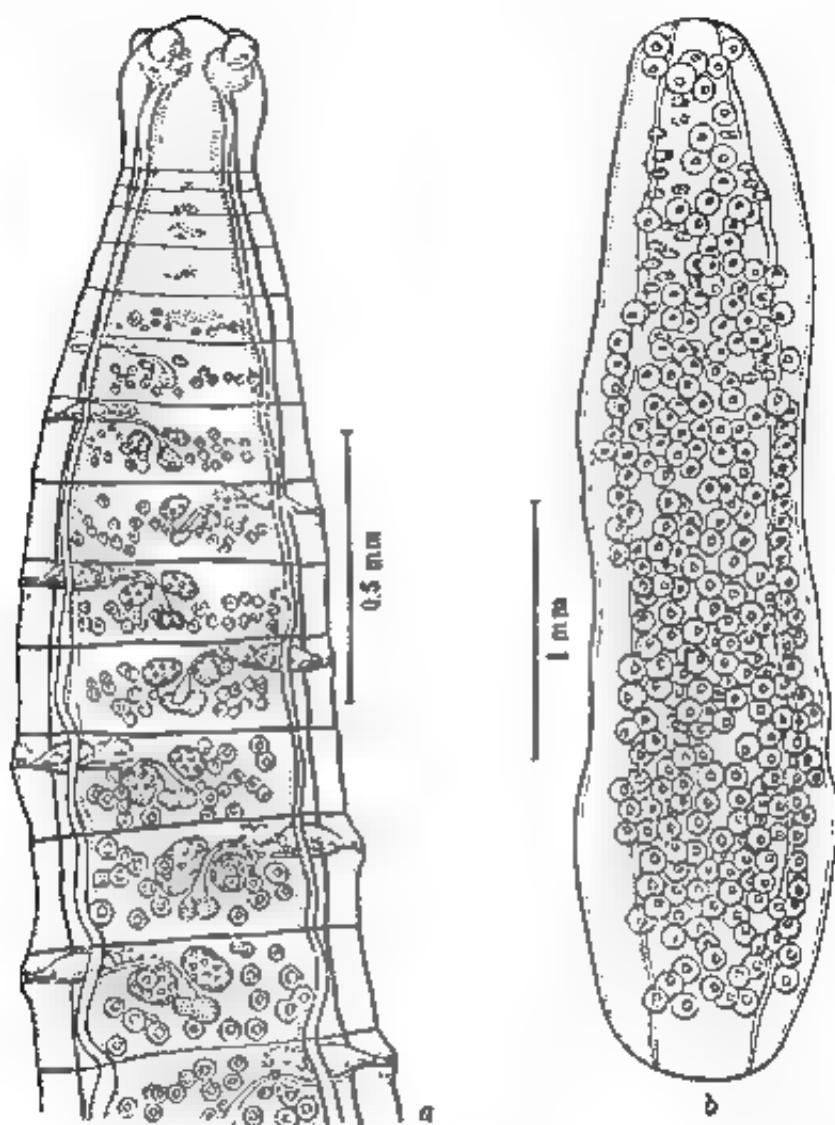


FIG. 5 *Ocularistics excelsus* sp. n. a. anterior end of worm showing ventral and buccal segments. b. a gravid segment.

short neck. Suckers 0.075 to 0.088 millimeter in diameter. Genital pores irregularly alternate, situated at posterior border of first third of lateral margins of mature proglottids. In gravid segments they occur at limit of anterior fourth or fifth of

mergins. Genital cloaca absent. Genital ducts pass between principal longitudinal excretory vessels.

Male reproductive organs appear to attain maturity before those of the female genital system. Testes spherical, 23 to 29 in number, 19 to 30 microns in diameter at posterior half of proglottids and extending anteriorly on both sides of median line to middle level of ovary, they are confined between longitudinal excretory vessels. Cirrus sac oval, 0.107 to 0.123 by 0.046 to 0.057 millimeter in size. In mature segments the cirrus sac extends mesially well past the longitudinal excretory vessels, while in gravid segments it does not pass beyond these vessels. Vas deferens short, in loose coils.

Ovary bilobed, immediately preequatorial, displaced slightly towards postero-lateral side of segment, lobes oval, 0.030 to 0.073 by 0.050 to 0.096 millimeter in size. Vitelline gland median, composed of two wings, 0.053 to 0.084 millimeter across, immediately behind ovary. Shell gland small, between ovary and rectal line gland. Vagina opens into genital pore behind cirrus. A distinct receptaculum seminis present. Uterine sacs are first seen in eleventh or twelfth segment; a fully developed gravid segment contains at least 250 of these sacs or capsules, each enclosing a single ovum. Uterine capsules 84 to 107 microns in diameter, oncospheres 38 to 46 by 30 to 34 microns in size, and the embryonal hooks about 19 microns in length.

Specific diagnosis. *Obchorotica*. Maximum length 26, maximum breadth 11 millimeters. Scolex 0.23 millimeter across. Genital pores irregularly alternate, at limit of anterior third of lateral margins of mature segments, in gravid proglottids at limit of anterior fourth or fifth of margins. Genital cloaca absent. Cirrus sac 0.107 to 0.123 by 0.046 to 0.057 millimeter in size, in mature proglottids half-crossing longitudinal excretory vessels, in gravid segments extending only to vessels. Testes 23 to 29 in number, 19 to 30 microns in diameter, reaching anteriorly to middle level of ovary. Uterine capsules 84 to 107 microns in diameter, oncospheres 38 to 46 by 30 to 34 microns in size, embryonal hooks 19 microns in length.

Habit.—Grazz lizard, *Mabuya multifasciata*.

Location.—Intestine.

Locality.—Los Baños, Laguna Province, Lazon.

Type specimens.—Philippine Bureau of Sciences parasitological collection, No. 506.

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ILLUSTRATION

TEXT FIGURE

FIG. 1. *Oöchorusites exsiccus* sp. nov., a, anterior end of worm showing necked and mature segments, b, a gravid segment.

DIE STAPHYLINIDEN DER PHILIPPINEN (GATTUNG OXYTELUS)¹

Von MAX REINHAGEN

Offizieller Natur- und Heim-Atlas Österreichs

Übersicht über die philippinischen Arten der Gattung Oxytelus

1	Erstes Fühlerglied gegen die Spitze nicht erweitert	>
	Erstes Fühlerglied gegen die Spitze wenig erweitert	8
2	Augen fein facettiert. UnterGattung <i>Taxyterus</i>	7
	Augen grob facettiert. UnterGattung <i>Careoporus</i>	7
3	Halschuh mit deutlichen Langsfurchen	4
	Halschuh fast ohne Andeutung von Furchen. Einfallig rotlichgebl. glänzend. fast unbeschwert. Kopf so breit wie der Halschuh, mit sehr großen, fast die ganzen Kopfseiten einnehmenden ziemlich fein facettierten Augen, fein und weitläufig punktiert ohne deutliche Einfältchen. Halschuh fast so breit wie die Flügeldecken. fast um die Hälfte breiter als lang, nach rückwärts gerundung, etwas am geschweiften Verengt, längs der Mitte mit einer sehr feinen, undeutlichen Langsfurche, an den Seiten schwach rückwärts rückt, fein und weit aufwärts, an den Enden etwas dichter punktiert. Flügeldecken etwas unregelmäßig punktiert. Abdomen fast unpunktirt längs 25 mm. Man h. <i>agricola</i> sp. nov.	
4	Die seichten Langsfurche des Halschuhes lang scharf und bei der Mitte zwischen den Schultern sehr tief und scharrig. Madagaskar, Philippinen, Neu-Britia vor. <i>furcata</i> bzw.	
	Die seichten Langsfurche rücke des Halschuhes mehr oder minder flach und undeutlich	5
5	Hinterleib mit durchgehender schwarzer Masse im r. Halschuh allein sich erweiternd. Java <i>epulus</i> bzw.	
	Hinterleib ohne schwarze Masse v. c.	
6	Körper grüner Halschuh zwittrig mit dicht langen geraden Überzähnen in malayischen Regionen vorwiegend et. <i>angustata</i> bzw.	
	Körper kleiner. Halschuh glänzend, zwittrig am v. weitläufig punktiert kaum angegestrichelt. Fast über den ganzen Tropen mit Ausnahme des afrikanischen Festlandes verbreitet. <i>fuscipes</i> & Kr. <i>angustata</i> bzw.	
7	Körper klein, Färbung tiefschwarz mit hellgelben Flügeldecken. Halschuh v. an den Seiten zwittrig gleichmäßig geradet mit abgerundeten Hinterzähnen. Über den grünen Teile der indomalayischen u. afrikanischen Regionen und Madagaskar verbreitet. <i>angustata</i> bzw. Körper grüner Halschuh zwittrig, nach rückwärts zwittrig mit mehr geraden Zähnen verengt mit sehr tiefen schwarzen Furchen. <i>separatus</i> v. <i>angustata</i> bzw.	

¹ Beitrag zur indomalayischen Staphylinidae-Fauna

8 Kopf beim Männchen mit zwei Stacheln am Vorderrand (Untergattung *Herpesticus* nov.) 24
Kopf beim Männchen am Vorderrand ohne Stacheln 9
9 Rückenfläche der Hl. gekreuzt durch eine kräftige schwarze Längsfalte von der herabgehenden Seiten begrenzt, Augen klein gesetzert (Untergattung *Asiopatylus*)

Körper sternförmig grau, Halschld. fast mehr als doppelt so breit wie lang, Leibf. rotbraun, der Kopf schwarz, die Flugdeckchen geschwarz, in sehr oft 2-3 Fäden bed. die Tragte an der Basis nicht oder selten schwach rot die Flügel nach unten. Kopf bei Männchen fast so breit wie der Halschld. beim Weibchen viel schmäler stark qu. & vorn stark eingedrückt, glänzend, hinten leicht und dicht, beim Männchen langer gestreckt, beim Weibchen mehr rautenförmig, die Schläfen beim Männchen nach vornwärts erweitert, viel länger als die Augen, beim Weibchen viel kürzer nach hinten nicht erweitert. Fühler gegen die Spitze ziemlich verschl. das vordere und folgende sind ungef. die folgenden eine sechseckige Kette bilden, die verlängert um die Hälfte breiter als lang. Der Halschld. ist am vorderen doppelt so breit wie lang, mit drei tiefen Längsfurchen und einem breiten Seitenandruck ziemlich kraftig und wenn sie weit auseinander gespannt glänzend. Flugdeckchen etwas länger als der Halschld. zum Teil stark und manig durch, hinten etwas längsrechteckig punktiert. Hinter der fast unmarkierten Länge 4 bei 8 mm. Luzon Los Baños Misamis Rizalina und Moncada.

Asiopatylus sp. nov.

10 Rückenfläche der Flugdeckchen ohne oder nur mit schwächer Rogen eingefüllt. (Untergattung *Asiopatylus*) 10
10 Vorderkörper mehr oder minder glänzend und gleich dunkel rot Grundfärbung hell 11
Vor. der Kopf mehr oder weniger hell, unmarkiert oder schwärzlich, Grundfärbung nicht schwarz 20
11 Halschld. nicht oder in sehr weiten Fällen nur manig dicht punktiert 12
Halschld. nicht punktiert oder gestrichelt 17
12 Flügeldeckchen einfach und nicht verlängert punktiert. Körper gr. rot. 3-4 mm bakar. Berüh. Flugdeckchen weniger als 2.5. sehr und kraftig unmarkiert hell 12
13 Körper grünlich (nur Kopf glänzend, nicht eingriniert)

Asiopatylus Winkl.

Körper 3-4. der (1.2 bis 2 x mm). Kopf weinrotens beim Männchen teilweise matt eingriniert 14
14 Kopf beim Männchen sehr stark erweitert, zwischen den Augen annähernd fein und ganz matt eingriniert ohne deutliche Punktführung, beim Weibchen glänzend, viel schmäler als der Halschld. Einfachig rotbraun, mit etwas dunklerem Kopf. Fühler ziemlich gestreckt, die vorderen Gl. oder schwach qu. er. Halschld. um mehr als die Hälfte breiter als lang, verkehrt trapezförmig mit drei tiefen Längsfurchen und je einem breiten Seitenandruck, hierach kraftig und wenig direkt markiert, glänzend. Flugdeckchen etwas länger als der Halschld. kraftig und leicht unmarkiert, wenig glänzend. Länge 1.5 bis 2.5 mm. Misamis. Buban. Luson, Mount Macabang Mount

Irazag, Brugan. Balibalan. Dayombung, Los Baños. Lamy. Tagumian
MINDANAO, Riz. prov. BILBAN heeft hier ap. vor
Kopf beim Männchen weniger erweitert, zwischen den Augen deutlich
punktiert 18

15. Halschld vornentlich an den Seiten dichter punktiert 16
Ha nach d. überall sehr weitläufig punktiert. Dens. Aest. sehr nah
verwandt und ihm in Gestalt und Färbung sehr ähnlich, durch viel
weiterläufigere Punktbewertung und besonders im männlichen Geschlecht
durch einen erweiterten und zwischen den Augen nicht matt glan-
zenden sondern matt glänzenden Ring und weniger deutlich
punktierten Kopf verschieden. Länge 2.3 mm. Luzon, Tagumian
pequeñezada sp. nov.

16. Kopf zwischen den Augen matt glänzend, d. wenig fein und wenig
dicht punktiert und stärker als bei d. d. auch Querfurchen
vom Sternenstiel gehend. Längsfurche Verkürzung wie bei den vorher
gehenden beiden Arten. Länge 2.2 mm. Luzon, Tagumian
ciliata sp. nov.

Kopf zw. oben den Augen wenig erweitert, d. wenig fein und zumal
dicht punktiert, d. Sternfurche noch sehr verhäl. Et. in der Far-
bung kaum verschieden. Länge 2.2 mm. Luzon, Bangui.

17. Flügeldecken grob und dicht, Rückenm. hinten am vord. spitzig punk-
tiert 18

Flügeldecken wenig grob und fein, bei der Brust doppelseitig und
kiefläufig skulptiert 19

18. Ha nach d. und Flügeldecken sehr dicht punkt. Et. wenig glänzend
Bei d. Rückenm. der H. teils in hellen Täster und teils in rötlicher
Färbung vertheilt. Kopf erkenntl. als bei Ha schw. matt d. und
weet ohne deutliche Partien vor der vord. begrenzten Sternfurche
ausgedehnt. Ha nach d. am H. Mitt. in Et. d. wenig, mit den
Rückenm. Flügeldecken, grob und sehr dicht, aber wenig punktiert
Flügeldecken etwas saenger als der Rückenm. grob und sehr dicht
deckt den Kopf und Et. an der Brust a. her. vord. spitzig er-
streckt. Länge 2.5 mm. Luzon, Legazpi, es ein gut Exemplar.

fast punctata sp. nov.

Rückenm. und Flügeldecken etwas dicht punktiert, als Et. oben
im übrigen kaum von dem vorigen verschieden. Länge 2.5 mm
Luzon. Ha schw. ein einzelnes Ex. exopt. balibalanica sp. nov.

19. Kopf zwischen den Augen ganz matt glänzend 20

Kopf zwischen den Augen deutlich etwas hellenglänzend 21

20. I abste. H. schw. etwas dicht und stark punktiert, gl. set. Kopf vor
vornehentlich in ein eingraviert ohne jede weitere Skulptur. Hinter
h. g. abhängend, mit hellen Tästern im Bereich. Der Kopf beim
Männchen müsse g. beim Weibchen viel schmäler als der Halschld, d. v. Beißf. beim Männchen so lang, wie im Weibchen v. d. kurzer als
der Längsd. rechteckiger der Augen. Halschld etwa um die Ha ste-
reiter als lang, abweich. von den meisten Heterodontinen stark und etwas
dicht gerunzelten punktiert, glänzend. Flügeldecken wenig breitig
und nach vorn d. nicht so langen, schw. ein Kiehnenk. ausgesetzt,
zumal glänzend. Länge 2.3 bis 2.6 mm. Et. nov. Tagumian und
Tagumian 22

23. 23

25 Halschld. um ein Drittel breiter als lang 26
 Halschld. wie die Hälfte breiter als lang. Rüttelgesch., matt, die Flügeldecken etwas dunkler. Kopf beim Männchen so breit wie das Halschld., mit jungen Schäfchen nach hinten etwas erweitert ansonst nicht eingeschnitten. Kopf Waden schmäler als der Halschld., Schläfen kürzer. Halschld. verkehrt trapezförmig, ausgesetzt dicht, matt eingeschnitten. Flügeldecken wenig längler als der Halschld., ebenso dicht wie dieser aber stärker ausgezogen. Länge 2,5 bis 2 mm. Lucas Mount Marueng. Mts. San Teodoro. *hispida* sp. nov

26 Hypens nicht glänzend, wie der obige Kopf matt. *obesus* Cam Kypaut mehr oder minder glänzend. 27

27 Körner sehr vors. bei Weibchen, Flügeldecken gehörnt punktiert *minutus* Cam Körner mit orangef. Flügeldecken dicht eingeschnitten. Fühler, Taster und Beine etwas blasser. Kopf schmäler als der der 26 (Weibchen) mit Ausnahme des Körpers matt eingeschnitten. Halschld. verkehrt trapezförmig etwas mehr als ein Drittel breiter als lang, mit eingeschnitten, die drei Halschld. durchen ziemlich scharf, so dass ein Eindruck durchdringt. Flügeldecken längler als der Halschld. nicht und deutlich vorgegrestet. Länge Kamm 1 mm. Lucas Los Batos, ein mittleres Weibchen. *hispida* sp. nov

28 Vorderkörper matt 29
 Vorderkörper mehr oder minder glänzend 30

29 Vorderkörper vollkommen glänzend, Halschld. ohne Auswölbung einer Mittelfurche, die Stacheln am Vorderrand der Stom beim Männchen an der Spitze nach außenwärts geschwungen. Schw. lebhaft am Wurzel der gebrauchten Füller und der Mund dunkler, die Beine heller rötlichgelb. Kopf beim Männchen fast breiter beim Weibchen schmäler als der Halschld. beim Männchen nach hinten erweitert, mit jungen Schäfchen beim Weibchen mit kürzer, nach rückwärts verengten Schäfchen, der Mundindruck beim Männchen stark, beim Weibchen schwach plattend. Die Fühler gegen die Spitze stark verdickt, die vorderen Gelenke stark quer, das erste Gelenk beim Männchen stark verdickt. In der Stom findet so breit wie die Flügeldecken, um die Halschld. breiter als lang, nach rückwärts stark verengt, die drei Mittelfurchen kaum angedeutet die seichten Enden sehr deutlich. Die Flügeldecken nicht eingeschnitten, bei gewössner Ansicht mit rötlichem Körperteil weniger lange als der Halschld. Halschld. glänzend nur undeutlich punktiert. Länge 2,5 bis 2,8 mm. Lucas Los Batos und Mount Marueng. Mts. San Teodoro. *planatocollis* sp. nov

Vorderkörper mit sehr schwachen, aber ummehr wahrnehmbaren Fettabschimmer Halschld. mit deutlicher Mittelfurche, die Stacheln am Vorderrand der Stom beim Männchen gerade. Fa. längs etwas weniger dunkel, die Flügeldecken an der Basis viel schwächer. Kopf beim Männchen nicht breiter als der Halschld., nach hinten kaum erweitert beim Weibchen beträchtlich schmäler als der Halschld. mit kurzen Schäfchen. Fühler kaum verschwollen. Mundindruck auch beim Weibchen deutlich glänzend und mit einem Lückchen verengt. Halschld. fast noch kürzer, mit schwelen Halsdecken vor

dannen unmerklich abweicht, die seitlichen Mittelfurchen gut ange-
dauert. Fächerketten ohne Kupfern auf. Länge 1 bis 2 mm.
Luzon Los Baños. Diapause. San Teodoro. *Veröffentlicht auf neu*

10 Halschild stark glänzend, nicht oder nur wenig verlängerte Längswulstheit
31

Halschild nur wenig glänzend, hemisphärisch dicht längsgestreift. Fächer-
ketten der Fächer und Täste 6, anfangs der Halschild, am vorderen Brustteil breiter
als lang nach rückwärts backwärts verengt, der Eindruck im
vorderen Teil sowie eine Mitte sowie aus dem erhabenen Teil abgeplattet.
Stark glänzend, an den Seiten haben den Augen stark Chagrinheit und
unter den Augen dicht Doppelwulstheit. Die Fächer sind etwas
verdickt, bei vom Hinterrand des Halschildes reichend, die vordersten
Glieder am die Hälfte breiter als lang. Ein Schulter am die Hälfte
breiter als lang nach rückwärts stark verengt vor dem schwarzen
Hinterdruck viel ausgezogen ist, an der Mitte mit drei starken Fü-
schen, zentral mit einem flachen Eindruck, dieche Auswölbung abgeplattet
ist vor die beiden Kiele zwischen den Fächeren geöffnet. Flügel-
decken länger als der Halschild, stark quer, sehr dicht und kräftig
langgestreckt, wie die Halswulstheit wenig glänzend. Halswulstheit
glänzend, kaum punktiert. Länge 21 bis 26 vom Mittelpunkt
Zungen

52 Halschild an den Seiten wenig verlängerte Längswulstheit und mit einem
oder ein starken Eindruck. Schmetterling mit breite, glänzend der
Ränder abgedunkelt. Im Winkel des Brustschildes, unter den Täste
und hinter Halswulst. Kopf so breit wie der Halschild, manch-
mal nur die lange Fächer den Augen große, unmerklich breiter an
den Seiten mit charakterist. Länge des breiten Mittelschildes und der
Hinterdruck verdeckt. Fächer kurz, die vordersten Glieder fast
abgeplattet, so lang. Halschild fast so breit wie die Flügel-
decken, stark quer, nach rückwärts stark verengt mit geradenzen
Seiten und zentral etwas flachen Hinterdruck mit tiefer Mittelfurche
in der Diagonale zwei kleinen Kielchen, seitlich klein und weniger
langgestreckt. Flügeldecken länger als der Halschild, weniger breit
als Längswulstheit, glänzend. Halswulst kaum punktiert. Länge 15
mm. Mittelschild, San Teodoro, ein einziges Männchen

Halschild an den Seiten ohne Strichbildung. Diapause verengt, bis
rechtfertigen glänzend, die Fächerketten die Täste und Diapause blaue-
gelb. Kopf beim Männchen nicht oder kaum schwächer als der Hals-
wulst, mit parallelen, den Augendurchmesser an Länge überschreitenden
Fächerketten, beim Weibchen nur schwächer als der Halswulst, auch rück-
wärts eng mit kurzen Schuppen glänzend platt, nur mit einzelnen
Fächeren, beim Männchen hinter den Fächeren anfangs fast chagriniert
und zwischen den Augen ungenügend fast schwer sichtbar längsge-
streckt. Stirn beim Männchen nicht wie bei den vorherigen Arten
mit zwei langen, gräulichen Stricheln an den Seiten, sondern mit zwei
sehr kleinen dicht aneinander liegenden Zeichnungen in der Mitte des Vor-
derzungen. Lederart. Bei der weiblichen Art. Halswulst ist bei Männ-
chen stark beim Weibchen manchmal quer, verdeckt längsgeformt und

stumpf verrhindeten Hinterecken, Eing. der Mitte mit einer in der Regel in der hinteren Hälfte verkürzten, bisweilen jedoch durchgehenden tiefen Längsfurche, sonst fast ohne jede Skulptur stark glänzend, ohne deutlichen Seiteneindruck. Flügeldecken etwas langer als der Halsschild, glänzend glatt, fast ohne jede Andeutung einer Punkterierung. Von *Oxytelus weewi* Fair., dem die Art sehr nahe steht, unterscheidet sie sich durch das Fehlen der seitlichen Mittelfurchen und der Seitengruben am Halsschild und den Mangel der Flügeldeckenpunkterierung. Länge 2 bis 2.5 mm. LUZON, Los Baños und Mount Banahao. MIKINASAO, Momungan und Port Blanga

Indostatus sp. nov.

NEW LONGICORN BEETLES FROM FORMOSA, III
(COLEOPTERA: CERAMBYCIDAE)

By J. LINSLEY GRESSITT

Of the University of California, Berkeley

ONE PLATE

The following descriptions are based on material collected by the author during two trips to Formosa, in 1932 and 1934, respectively. Two of the forms herein described are interesting as being subspecifically related to more northern forms, from north-central China and the northern Loocloo Island, respectively. Several of the other new species represent various new genera, some of which are apparently without very close affinities, and others have tropical Oriental relationships. The types are deposited in the United States National Museum, Washington, D. C., and in the California Academy of Sciences, San Francisco, those in the latter being unnumbered unique types on loan deposit. Types previously designated by the writer as "in the author's collection" are similarly deposited in the collection of the California Academy of Sciences. The author is indebted to Dr. E. C. Van Dyke and Mr. E. P. Van Duzee for use of material in the California Academy of Sciences.

CERAMBYCIDAE

Cerambyx minutum Gressitt¹ is a synonym of *Dymasius kianus* Matsushita,² having been published one day later than the latter name. The type locality of *C. minutum*, "Kamikochi, Japan," is erroneous, and should have been Kian, Formosa, the same as for *D. kianus*. The author's specimen was received in 1932 from Y. Yano, the collector of Matsushita's material, but it was in an envelope with lepturids from Kamikochi. The carelessness of the above collector is further evidenced by the writer having seen lepturids from Kamikochi in collections sent to this country labeled as from Kian, Formosa.

¹Philipp. Journ. Sci. 56: 379, published March 8, 1935.

²Trans. Nat. Hist. Soc. Formosa 26: 540, published March 7, 1933.

CALlichROMINE

Genus AROMIA Scoville, 1833

AROMIA FALDERMANNI *obso.* INSULANIS *Gravell* *obso.* *var.* *Plate I, fig. 1*

Large handsome, body largely iridescent green or violet, head violet-black greenish on frons and occiput, mandibles blue at base, antennae dull blackish apically, scape shiny lavender blue, or green, the following three segments iridescent purplish blue, prothorax purplish blue with a large orange area on each side reaching from apex to near base and to two pairs of tubercles on each side of middle of disc, greenish and coppery below, the process bluish black; scutellum deep blue or green, elytra variable, greenish basally, remainder greenish purplish brown, legs purplish blue or greenish, tarsi testaceous ventrally, surface dark greenish with purplish tinges.

Head broad, antennal supports high and close, frons small, genae large, surface minutely punctulate, irregularly clothed with dark hairs. Antennae slightly longer than body, in male three-fourths as long in female, third segment longest, fourth to tenth decreasing slightly, acute externally at apices. Prothorax broad, with a thick tubercle at each side, and six on disc. One behind middle of anterior margin, a pair near center and three posteriorly, outer posterior ones highest, subtransverse, surface with erect dark hairs, particularly on the purple areas. Scutellum elongate-triangular, grooved. Elytra slightly narrowed, rounded apically, and microgranulose punctate. Hind tibial compressed and sinuate; first segment of hind tarsus not quite as long as remaining united. Length, 34 to 46 millimeters, breadth, 9.5 to 12.5.

Holotype, male, No. 51424, United States National Museum, Hukou, central Formosa, altitude 1,400 meters, June 16, 1934, a type, female, Hassenzan, Formosa, altitude 1,000 meters June 24, 1934, paratotype, male, June 15, five paratypes, Hsia Formosa altitude 600 meters, June, 1934, and one paratype male, Hsiaoyama, northern Formosa, altitude 1,600 meters, July 16, 1934 (*Y. Izumi*) in the author's collection, one paratype, Hsia, in the California Academy of Sciences.

Differences from *Aromia faldermanni* Saund.,² from northern China, as which the present form has already been recorded from Formosa, in being larger, in having the antennae entirely dark, instead of orange on the latter seven segments, and in

² *Trans. Ent. Soc. London* II 24 (1850) 111, pl. 4, fig. 7.

aving the orange portion of the prothorax separated into two spots, with the central portion violet, instead of extending completely across the dorsal surface. In *insularis* the vertex is more deeply and narrowly grooved, the prothorax is more constricted before the lateral tubercles, the posterior triangle of each side of the base is more pronounced, and the scutellum is narrower and more deeply grooved. Specimens from northern Formosa (Hsin-kang) differ slightly in having the scape and anterior parts of legs more greenish, than purple and the elytra largely greenish but the iridescent coloration in these forms is exceedingly variable.

Genus CHI-ORIDOLI M. Thomson 1864

CHI-ORIDOLI LOO-CHOOANUM subsp. TAIWANUM Cresson subsp. nov. Plate I, fig. 2

Moderately small, elegant, bright green, antennae violet-blue, legs steel blue, pronotum bluish on disc, scutellum shiny, slightly bluish green, extra frosted green lighter on shoulders and along basal portion of suture, slightly darker on disc, mandibles black at apex, palp testaceous, with apical segments of both pairs brown except at apex, ventral surface bright green, finely clothed with short silvery pile.

Head moderately punctured on occiput and behind eyes, more free, and sparse, on vertex, frons, and genae and finely and densely on mandibles, rear area transverse, and shielded areas sublongitudinally corrugated, frons and vertex narrowly midlongitudinally subacute to between eyes. Antennae two and one-third times as long as body, male one-third longer, female scape thick, subacute ectoapical, grossly punctured subobliquely grooved externally, fourth segment slightly shorter than third, last longest. Prothorax longer than breadth at base, laterally armed slightly behind middle with a blunt tubercle with a short, acute tip, disc transversely striolate near apex and base, transversely or obliquely so at sides, and longitudinal in middle with the outer longitudinal stroke diverging and incomplete, meeting the lateral ones in a blunt punctured area on each side of center, underside transversely corrugated anteriorly, subvertically punctate posteriorly, area around lateral tubercles smooth. Scutellum triangular, subacute behind, longitudinally grooved, nearly impunctate. Elytra narrowed posteriorly, apices narrowed and obliquely angulate near suture, surface granulose, except a long suture near scutellum where it is finely, transversely corrugated and shiny. Legs all ventral surface finely punctured. Length 14 to 18 millimeters, breadth, 3 to 4

Holotype, male, No. 51425, United States National Museum, Rakai, Formosa, altitude 1,400 meters, June 12, 1934, allotype, female, and six paratypes in the author's collection, one paratype in the California Academy of Sciences, all taken by the author, June 12 and 14.

Differs from *C. louchuanus* Gressitt,¹ from Amami Oshima Island, in being smaller, in having the elytra green instead of bluish, only the central part of the disc of prothorax blue, the labrum green instead of black, the vertex lacking ridges and stripes parallel to the median groove, the scutellum narrower and longitudinally grooved, the elytra more strongly narrowed and more acute apically, and the abdomen smoother.

MOLORCHINI

Genus KURAKUA Gressitt novum

Narrow, elytra narrowed and slightly outwardly curved posteriorly, slightly abbreviated; antennae with third segment minute, posterior seven segments long and thickened, eyes finely faceted and emarginate; anterior coxae subconical, their cavities subacute externally, and apparently open behind middle coxa, cavities very narrowly open externally.

Head longer than broad, slightly broader than prothorax, neck narrowest immediately behind the eyes, eyes minutely faceted, prominent, very narrowly constricted behind the antennal insertions, the antennal supports broad, rounded, the vertex narrow medially sulcate to middle of frons, with a row of punctures on each side, frons short and broad, an impunctate area at middle of apical margin and a pit at each side near clypeus, clypeus very broad basally, basal margin rather concave, apical margin slightly so; labrum transverse, very short, mandibles moderate, apices acute, sides densely punctate, palpi short, the last segment subelliptical; genae short. Antennae (male?) one-third longer than body, moderately thick, except for second to fourth segments: scape three times as long as broad, arched, second segment minute, longer than broad, thickened apically, third segment minute, no thicker than, and but twice as long as second; fourth segment half again as long as third, subequal to scape; fifth segment large, as long as two preceding combined, apex broadened, external angle subacute. Following segments similar and progressively slightly longer; apical segment longest, with the apical fifth narrowed, first four segments

¹ Pan-Pacific Entomol. 9: 163.

Holotype, male, No. 51425, United States National Museum, Lukang, Formosa, altitude 1,400 meters, June 12, 1934, a lototype, female, and six paratotypes in the author's collection, one paratotype in the California Academy of Sciences, all taken by the author June 12 and 14.

Differs from *C. weberi* Gressitt¹ from Amami Oshima Island in being smaller, in having the elytra green instead of bluish, only the central part of the disc of prothorax due, the labrum green instead of black, the vertex lacking ridges and striole parallel to the median groove, the scutellum narrower and longitudinally grooved, the elytra more strongly narrowed and more acute apically, and the abdomen smoother.

MOLOCHINI

Genus KIRARI A. Gressitt novum

Narrow, elytra narrow and slightly outwardly curved posteriorly slightly abbreviated, antennae with third segment minute posterior seven segments long and thickened, eyes finely faceted and emarginate, anterior coxae subacute their cavities subacute externally, and apparently open behind, middle coxa cavities very narrowly open externally.

Head longer than broad, slightly broader than prothorax, neck narrowest immedately behind the eyes, eyes minutely faceted prominent, very narrow & constricted behind the antennal base, frons the antenna supports broad rounded, the vertex narrow, medially sulcate to middle of frons with a row of punctures on each side frons short and broad, an impunctate area at middle of apical margin and a pit at each side near clypeus clypeus very broad basally basal margin rather concave, apical margin slightly so labrum transverse, very short, mandibles moderate, apices acute, sides densely punctate, palpi short, the last segment subapical, genae short. Antennae (male?) one-third longer than body, moderately thick, except for second to fourth segments scape three times as long as broad, arched, second segment minute longer than broad, thickened apically, third segment minute no thicker than, and but twice as long as, second fourth segment half again as long as third, subequal to scape, fifth segment large, as long as two preceding combined apex broadened external angle subacute following segments similar and progressively slightly longer apical segment longest, with the apical fifth narrowed first four segments

¹ Pan-Pacific Entomol. 9: 163.

slightly shiny and punctate, following segments dull covered with minute, recumbent, bristle-like hairs. Prothorax subcylindrical two-fifths again as long as broad narrower than elytra, base as broad as middle, apex slightly narrower, disk fairly even, moderately sparsely punctate. Scutellum minute and narrow, apical portion concave. Extra narrow, broadest basally, constricted anteromedially, slightly narrowed posteriorly, not quite reaching apex of abdomen, apices narrowed externally and rounded, surface with fairly dense shallow punctures. Anterior coxal cavities slightly rounded, broader than long, subacute externally, apparently open behind, moderately separated, the intercoxal process expanded and rounded posteriorly, middle coxal cavities extremely narrowly open to epiphora, intercoxal process of mesosternum broad, reaching, but beyond middle acetabula, its apex concave, receding process of metasternum, metasternum swollen and fairly densely punctured; metepisternum large, swollen posteriorly. Abdomen with first segment nearly as long as following two combined, second to last segments subequal, the fourth shortest. Legs fine, femora puberulent and apically clavate, hind tibia slightly arched, first tarsal segments slightly shorter than following two segments combined in anterior pair, subequal in second pair, and only slightly longer in hind pair.

Genotype—*Akkabis constrictipennis* Gressitt sp. nov.

Range.—Formosa (southern tip).

This genus is doubtfully placed in the Melocharini because the anterior coxal cavities are seemingly opened behind and the middle coxal cavities are very narrowly open externally. It differs from most of the genera in the tube in the very short third and fourth antennal segments, the smooth prothorax and long elytra. It differs from Akkabis in its much narrower form, longer and different antennae and prothorax, and more suddenly, and more briefly, clavate hind femora.

SCARABAEIDAE (CONTINUED FROM P. 88, THIS VOL.)

Black, prothorax (except anterior margin) and forelegs red; elytra reddish brown basally and grayish brown on apical two-thirds. Body clothed with reddish brown hairs above and whitish hairs below.

Moderately small narrow, prothorax long and plain, elytra constricted anteromedially, narrower and divergent posteriorly, not quite reaching apex of abdomen; antennae slightly longer than body third segment minute, only twice as long as second, and two-thirds as long as fourth, the latter equal to scape, fol-

lowing segments long and thick, slightly flattened; legs fine, femora pedunculate and clavate, hind pair barely so for apical third. Length, 9.2 millimeters; breadth, 1.8

Holotype, male (?), California Academy of Sciences; Kurnu, Koshun, near South Cape, Formosa, altitude 140 meters, April 10, 1932, taken by the author.

This species superficially resembles *Cleomenes satigera* Schw in appearance, because of its narrow form, red thorax, and clavate femora, but is easily distinguished by its peculiar antenna, more cylindrical prothorax, and narrowed elytra.

Genus *MERIONEDA* Pascoe, 1835

Matsushita¹ has synonymized *Merioneda uracusa* Kano² with *M. formosana* Heller³ and Mitono⁴ has followed him. These species, however, are quite distinct. The two may be distinguished as follows:

Eighth and ninth antennal segments one-fourth as broad as long; middle femora clavate for less than apical half; hind femora clavate for only apical third, the club narrower than head, tibial spines not red.

M. uracusa Kano (fig. 6)

Eighth and ninth antennal segments half as broad as long, middle femora clavate for their apical half; hind femora clavate for nearly their apical half, the club as broad as the head, tibial spine subperpendicular

M. formosana Heller (fig. 7)

CLYTINI

Genus *XYLOTRECHUS* Chevrolat, 1860

XYLOTRECHUS MUPONOTATUS Gressitt sp. nov. Plate I, fig. 3

Moderately small, narrow, attenuated posteriorly, body black except for an orange-red pronotal spot centered slightly before middle of disc, surface densely clothed above with green pale, paler on scutellum, and below with greenish gray, paler at the sides, antennae basally with sparse, fine, greenish hairs, apically with microscopic recumbent hairs; legs sparsely clothed with short, and some longer erect, pale hairs.

Head abbreviated below, surface granulose punctate with some large punctures below eyes, vertex and frons with a pair of approximate carinae, converging at each end, on middle of vertex, and lower part of frons; frons narrow, subparallel, very slightly narrowed in middle, lateral carinae obscure; eyes

¹ Journ. Fac. Agr. Hokkaido Imp. Univ. 24 2 (1932) 229.

² Ins. Matsuyama 5 (1930) 43, fig. 1.

³ Ent. Blatt. 20 1 (1924) 32.

⁴ Mushi 8 1 (1935) 32.

inverted comma-shaped, palpi fine, apical segments twice as long as broad, rounded-truncate, not broadened, apically. Antennae (female) short, fine, thickened apically, scape over twice as long as second segment and slightly longer than third, fourth and fifth subequal, each slightly shorter than third; following decreasing, tenth hardly longer than its diameter. Prothorax longer than broad, subcylindrical, only slightly swollen at sides, apex nearly as broad as base; disc somewhat raised postmedially, surface densely and fairly heavily punctured, some very large shallow punctures at sides. Scutellum rounded, less than twice as broad as long. Elytra slightly broader than prothorax, not quite twice as long as head and prothorax united, gradually narrowed posteriorly, apices subtransversely truncate, a very short tooth at sutural angle; surface densely and finely punctured. Metepisternum very narrow, apparently broader posteriorly. Legs with femora only slightly swollen, middle femora most heavily punctured; hind femora slightly exceeding elytral apices; first segment of hind tarsus two and one-half times as long as following two united. Length, 11 mm. meters; breadth, 2.8.

Holotype, female, a unique, California Academy of Sciences, Hassenian, Formosa, altitude 1,800 meters, June 21, 1932, taken by the author.

Differs from *X. cinerascens* Matsushita in its smaller size, more parallel and less prominently carinate frons, the two sides of the narrowly elliptic carinae very close, the prothorax more cylindrical, the scutellum narrower, and the first segment of hind tarsus relatively shorter.

Genus PFRISSE'S CRISEUS Chevrolat, 1863

PFRISSE'S CRISEUS Chevrolat sp. nov. Plate 1, fig. 2.

Small, abbreviated, subparallel; body black, fairly well clothed with pale greenish gray pubescence, whitish on sides of hind margin of prothorax and undersurface of body, where it is denser on sides of meso- and metathorax, body also with many erect pale hairs, except on tarsi and posterior three-fourths of elytra antennae with some moderate hairs on scape and a few projecting ones on inner side of following four segments, besides very fine pubescence covering their entire surface.

Head wider than high in front; finely punctured, with some large punctures on occiput and genae; antennal insertions moderately distant, hardly raised, vertex plain; eyes inverted comma-shaped, deeply constricted; frons nearly as broad as long,

clypeus glabrous apically, apical palpal segments subtransversely truncate. Antennae (female) hardly over half body length, somewhat thickened apically, scape as long as second and third segments combined, fourth shorter than third, equal to following; latter few, slightly shorter. Prothorax subcylindrical no longer than broad, slightly broader at apex than base, slightly swollen at sides; granulose-punctate above. Scutellum short broad, and rounded. Elytra twice as long as head and prothorax united, broader than prothorax, slightly narrowed posteriorly separately narrowed and subobliquely truncate at apices, surface minutely granulose-punctate. Legs fine; hind femora and tibiae sinuate, the femora reaching just beyond elytral apices, first segment of hind tarsus barely twice as long as following two segments united. Length, 8 millimeters; breadth, 21.

Holotype, female, a unique, California Academy of Sciences, Taiwan, Formosa, altitude 1,600 meters, May 10, 1932, taken by the author.

Differs from *P. hankowensis* Schwarzer and the other species of the genus in lacking spots or fasciae. The head is very short in front, the prothorax short and the scutellum broad.

Genus *RAPHICHA* Pascoe, 1858

RAPHICHA NOTABILOIDES Cresson in Proc. Acad. L. 4.

Large, cylindrical, subparallel; body black, densely clothed with green or gray pubescence, paler beneath and nearly white at sides, marked with black as follows: A transverse suboval black spot on each side of middle of disc of prothorax, elytra with the external margins narrowly so for most of their length each with a straight longitudinal stripe from humerus to end of first third, a line curving out from behind scutellum, extending posteriorly, then transversely outward, joining end of humeral stripe, next a fairly large irregular median spot, touching margin but not suture, and finally a large, free, subcircular spot, one-fourth from apex, antennae clothed with fine, adpressed, greenish gray hairs; some suberect brownish hairs on underside of third and fourth segments; legs with the fine hairs goldish and tibiae.

Head strongly punctured on either side of occiput and below eyes, eyes large, distant, frons slightly longer than broad, narrowed basally. Antennae five-sixths as long as body in male, four-fifths in female; third segment longer than scape, fifth to seventh subequal, each longer than fourth and shorter than

th rd, remaining shorter; seventh to tenth broadened externally at apices. Prothorax broadest behind middle, narrowed apically surface finely granulose. Scutellum rounded behind. Elytra slightly broader than prothorax, less than twice as long as anterior part of body; apices subobliquely truncate, dentate at both angles. Legs fairly fine, hind tarsi with first segment twice as long as following two united. Length, 17 to 20 millimeters; breadth, 4 to 4.5.

Holotype, male, No. 51426, United States National Museum, Sakaben, eastern Formosa (southwest of Karenko), altitude 1,350 meters, July 13, 1934, two paratotypes and a female doubtfully referred to this species, Hasseuzan, Formosa, altitude 1,400 meters, June 28, 1934, in the author's collection; all taken by the author.

This species is very similar in size and markings to *Chlorophorus notabilis* Pascoe, and quite probably represents the form recorded from Formosa as that species. It differs from the latter in having the antennae much finer, with the third segment longer than the first, the pronotum smoother, and the legs much finer, with the first tarsal segment much longer. Differs from *Raphuma rirens* Matsushita in its much larger size, more sulphurous coloration, more swollen prothoracic disc, and relatively longer third antennal segment and first hind tarsal segment. One of the paratotypes is gray instead of yellowish green, with the markings less distinct. The specimen from Hasseuzan is entirely gray.

Genus DEMONAX Thomson, 1860

DEMONAX MATSUSHITAI Gressitt sp. nov. Plate I, fig. 10.

Small, narrow, parallel; black, clothed with gray pubescence, elytra with three pairs of dull black fasciae, the first consisting of a narrow oblique line from suture just behind scutellum to middle of disc, one-fifth from base, and a curved humeral line which nearly meets the former at its apex, second a moderately broad suboblique band slightly before middle, reaching from suture to margin, narrower anteriorly near suture, third transverse, wide, one fourth from the apex, slightly constricted at the suture, all the bands with a few intermixed gray hairs and their margins indefinite, scutellum and undersides of pro- and mesothorax whitish gray; some suberect pale hairs on legs and undersurfaces of basal antennal segments and apices of following segments.

Head small as deep as wide, occipital with some large punctures at sides, eyes distant, deeply emarginate, vertex concave, antennal supports subacute, intertarsal frons longer than broad, broader apically. Antennae nearly as long as body in male, reaching to last quarter of elytra in female, scape not swollen apically, twice as long as second segment, third nearly half again as long as scape and fourth fifth longer than fourth and following, third and fourth each with an apical spine one-fourth as long as the following segment, and of the fourth the longer. Prothorax one-fourth longer than broad, and very briefly constricted at apex and base, sides moderately swollen, surface shallowly reticulate-punctate with a few deeper punctures postero-laterally. Scutellum narrowly rounded behind. Elytra slightly broader than prothorax, parallel, apices transversely subsinuate, truncate, external angles minutely toothed. Legs long, hind femora hardly swollen, hind tarsi shorter than tibiae, first segment nearly twice as long as remaining segments. Length, 8.5 millimeters.

Holotype, female, No. 31427 United States National Museum, Hassenzan, Formosa, altitude 1800 meters, June 24, 1931, and paratotype male in the author's collection, taken the same day.

Differs from *L. scutellata* Matsushita in a slightly larger size, more briefly pained third and fourth antennal segments, and narrower elytral bands, the first extending obliquely from behind scutellum beside another on humerus. Named in honor of Mr. Masaki Matsushita, of Toyohara.

Genus *CHLOROPHORUS* Chevrolat 1863

CHLOROPHORUS LEPIDOCALCIDES Gressitt sp. nov. Figs. 1, 2, 11

Laterally compressed, slightly narrowed behind, body black, orange at either side of scutellum, large yellow blotched with pubescence, head and antennae sparse, clothed with gray, prothorax largely clothed with grayish green, greenish yellow at each side of base margin and greenish white beneath scutellum, densely clothed with pale yellow elytra black, slightly yellowish on base, margin and crossed by fasciae of greenish yellow, the first extending obliquely from suture slightly behind scutellum to one-third from base, where it turns exteriorly and somewhat anteriorly, not reaching margin, the second transverse, two-thirds from base broad, at suture narrowing laterally, not

reaching margin; its hind margin straight, the third an oblique apical spot bounded by a line from suture, halfway between second band and apex, to external apical angle, black portions with some adpressed bronzy hairs visible in certain lights, ventral surface grayish below and yellowish at sides, legs moderately clothed with receding, and a few erect, hairs, some erect pale hairs on head, underside and bases of prothorax, and clytra, antennae with some internal hairs fused to form false, subapical spines on most of the segments.

Head deep, hardly broader than apex of prothorax, heavily punctured, a few larger and shallower punctures on sides of occiput, antennal insertions distant, frons twice as high as wide, slightly broader apically, a low median carina extending most of its length, genae fairly long; apical palpal segments broadened and subobliquely truncate apically. Antennae (female) fine, just over half as long as body, scape small, three times as long as second segment, equal to third, fifth just longer than fourth, shorter than third; remaining shorter than fourth, successively diminishing in length. Prothorax one-fourth longer than broad, hardly narrower at apex than at base, only slightly swollen at sides, surface granulose. Scutellum broadly semi-elliptical. Elytra not quite twice as long as head and prothorax united, slightly broader than prothorax, moderately narrowed posteriorly, transversely subsinuate-truncate apically, base swollen in middle; surface finely punctate. Ventral surface fairly densely and fine-punctured; visible portion of metepisternum hardly broader anteriorly than posteriorly. Legs fairly long, the hind femora extending one-fifth their length beyond elytral apices; middle femora very heavily punctured, hind tarsi with first segment nearly half again as long as remaining united length, 12 millimeters; breadth, 3.

Holotype, female, a unique, California Academy of Sciences; Seishia, by Lake Candidus, central Formosa, altitude 750 meters, May 31, 1934.

This species is not closely related to any other species of the genus known to me. It differs structurally from *C. signaticollis* Chevrol in having the head longer, the antennae finer, more distantly inserted, and with false subapical spines, the prothorax narrower, the scutellum smaller and the hind legs longer. It is very similar in markings to large specimens of *Perissus kauaensis* Schwarzer. Possibly this species should be placed in

Dentipes, because the antennal insertions are rather distant, but the spines on the inner sides of antennal segments are composed of groups of hairs instead of extensions of the segments, and furthermore, the third antennal segment is not longer than the scape.

COLOBORHYNUS MIWAI DODDIE sp. nov. Plate I, fig. 21

Cylindrical, parallel; black, largely clothed with dense green pubescence; head and antennae green, prothorax green, with a black spot on each side, and a wide, inverted Y-shaped black marking on disc; scutellum green; elytra green, marked with three sets of fasciae. The first a zerolike mark on basal portion, not touching suture barely touching base and with a short extension along external margin, the second a wide, transverse band at middle, nearly straight behind, and extending anteriorly some distance along suture, another anterior extension joining hind part of zerolike mark at side; the last a large squarish spot in last third, free from suture and apex but touching margin; ventral surface clothed with paler green, nearly white on the pleura; legs sparsely clothed with grayish green.

Head higher than wide; front squarish; eyes inverted comma-shaped antennal insertions fairly close, occiput heavily punctured on sides. Antennae (female) slightly more than half as long as body, scape slightly arched, barely longer than third segment, fourth slightly shorter than third; following gradually decreasing, most of the segments with a row of fine setae below. Prothorax subglobular, slightly longer than broad, narrower at apex than base. Scutellum slightly narrowed, rounded at apex. Elytra fairly long, slightly narrowed, apices obliquely truncate hardly toothed at either angle. Legs fairly fine, hind tibiae fairly prominently spined internally at apex; hind tarsi with first segment as long as remaining united. Length, 15 to 16.6 millimeters; breadth, 3.6.

Holotype, female, United States National Museum, Barasan, Northern Formosa, altitude 1,750 meters, July 23, 1934; paratype, female, in the author's collection, Hori, Formosa, July, 1934; paratype, male, Tai Kwong, Lam Mo district, Hunan Province, China, July 26 to 28, 1934 (F. K. To), in the collection of the Liangnan Natural History Survey and Museum, Canton.

Very similar to *C. rufipes*, of Europe, and *C. dubius* Matsushita, of Formosa, differing from both in having the elytra longer, the

Pubescence green instead of yellowish gray or whitish gray, the discal marking of prothorax different and other characters

STEREOPHILUS

Genus BUKOTHORAX Gressitt nov. gen.

Body strongly compressed dorsoventrally, antennae with basal segments tufted, prothorax 11 noded, elytra 13-cornute, legs short.

Head abbreviated anteriorly, frons short, vertical, vertex broad, concave, grooved medially, occiput smooth, unpunctate, eyes deeply constricted, moderately finely faceted, eyes approaching mandibles, genae minute, palpi short, apical segments compressed, truncate apically. Antennae (male) half again as long as body, first six segments heavily clothed with long black bristles on apical half, following segments with only a few hairs, scape strongly thickened, shorter than third segment, second longer than broad, third and fourth equal, each slightly shorter than fifth to tenth, which are subequal, last twice as long as third, fourth to ninth subangulate externally at apices. Prothorax nearly twice as broad as long, disc with some more or less rounded tubercles, one at each side near anterior margin, a pair just before middle, one behind center and two at each side near hind margin, each side also with a strong, blunt tubercle, some large irregular punctures between or on sides of tubercles, surface furnished with long black bristles, as on head. Scutellum equal laterally, triangular, subacute, concave basal; Elytra separately produced anteriorly at middle of base, narrow basally, hardly broader than prothorax, very slightly broadened posteriorly, rounded apically, disc with three strongly raised ones, another weaker one between outer two, surface deeply and grossly punctate, reticulate, glabrous, a few short black hairs along posterior portions of outer margin. Prosternal process rounded, pronotal mesosternal process narrow, squarish in lateral outline, slightly more prominent anteriorly, middle coxal cavities open externally. Legs short, first segment of hind tarsi less than three length of second.

Genotype.—*Stereophiles tatei* (Jacoby) Kano

Range.—Formosa.

This genus differs from *Stereophiles* Gmel. in having a much flatter body, shorter, tuberculate prothorax, plumed antennae, more strongly carinate and punctate, and more glabrous, elytra, longer pro- and mesosternal tubercles, and shorter legs.

MUNOTOMA TAKAHAGENIUS (Kano). Plate I, fig. 2.

Sternophorus takahagensis Kano, Kontyu (Tokyo) 8 (1933) 272.

Body black, elytra bright red, basal antennal segments with tufts of posteriorly directed black bristles, head and prothorax with erect black bristles, prothorax shiny, with eleven rounded tubercles, elytra nearly naked, strongly punctured and ribbed Length, 13 to 16 millimeters.

Distribution.—Formosa, Arisan (type locality). Taiheisan, a male in the author's collection, June, 1934.

NEOBORN:

Genus *BAIMIA* Pascoe, 1866

(?) *BAIMIA BIRTHORNIS* Gressitt sp. nov. Plate I, fig. 12.

Moderately narrowed, subparallel; antennae very hairy posteriorly. Body black, clothed with pubescence of mottled gray-brown, marked with brown, light gray, and ochraceous, head incompletely clothed with pale buff, mottled with darker in front and with a pair of longitudinal dark brown stripes on occiput, and another behind each upper eye lobe, antennae with scape gray, the following segments pale gray basally and black apically, apical segments largely black, long internal hairs similarly colored, longer and denser posteriorly; prothorax gray-brown, spotted anteriorly with ochraceous and with four indistinct dark stripes on disc; elytra whitish gray, dotted with black punctures, crossed by two irregular brown fasciae, one behind base, the other behind middle, and spotted irregular with ochraceous; undersurfaces densely clothed with gray and ochraceous, reddish on posterior margins of abdominal segments, also some flying gray hairs, legs brown and buff; tarsi with first, second, and last segments light gray basally, black apically, the third entirely black.

Head sparsely punctured; eyes small, the two lobes connected by a fine line, frons higher above than below. Antennae one-fourth longer than body, apical segments and apical portions of basal segments clothed internally with long hairs, scape with an incomplete clavatrix; third segment longer than scape and fourth, following rapidly decreasing in length. Prothorax broader than long, tuberculate anteriorly at sides, disc with five swellings, a pair of elongate ones in the middle and three in a transverse row near base. Scutellum small and narrow. Elytra broad, rounded behind, surface sparsely and heavily punctured. Sternal processes with opposing faces vertical Length, 13 to 14 millimeters breadth, 4.5 to 5.

Holotype, female (?) No. 51429, United States National Museum, Hsien-zen, Formosa, altitude 1,300 meters, June 21, 1932, two paratypes in the author's collection, and a para-topotype in the California Academy of Sciences (Van Dike collection), June 22 to 26, 1934.

This species differs from *S. alternans* Schwarzer with its hairy antennae the scape and apical segments shorter, its tuberculate prothoracic disc, and its vertical sternal processes.

THIRTY-FOURTH

Genus *PSEUDOCALANUS* Kraatz, 1879

PSEUDOCALANUS LEPIDUM Gmelin, 1771. Pl. 1, fig. 24

Extremely narrow and elongate, antennae very fine and long, head fully as deep as rest of body, brown, anterior femora and scape dull reddish brown, rest of antennae dark brown, head and thorax blackish brown, reddish brown on posterior margin of pronotum, clypeus dark amber, labrum light reddish brown, mandibles and palpi dark reddish brown, elytra dull chocolate-brown, reddish at sides, legs and abdomen very dark chocolate-brown; antennae with basal five segments clothed below with fine erect hairs, rest of body very finely clothed with minute, pale grayish brown hairs, sparser on elytra and denser on midline of pronotum, scutellum, and basal portion of elytral suture.

Head squarish in front, excluding mouth parts, broadest at eyes, slightly broader across genae than at antennal tubercles; vertex fairly deeply concave between antennal tubercles, which are prominent, and swollen internally; frons weakly convex, apical margin slightly concave, clypeus short, impunctate, labrum convex, punctulate, palps with apical segments of each pair swollen basally and acutely attenuate apically. Antennae two and one-half times as long as body, exceedingly fine, scape cylindrical, reaching well beyond middle of prothorax, second segment barely longer than broad, third segment longer than first and shorter than fourth, fourth to tenth subequal, eleventh nearly double third. Prothorax roughly cylindrical, one-third longer than broad, widest before and behind middle. Scutellum longer than broad, rounded behind. Elytra long and narrow slightly narrowed posteriorly, apices narrowed externally and produced into a blunt point at suture. Abdomen with first segment nearly twice as long as fourth, others subequal. Legs with femora swollen, hind pair no longer than first abdominal segment. Body largely finely punctured, elytra subserrate, abdomen most finely, and antennae and lateral portions of the a-

sternum most heavily. Length, 10.5 to 12 mm., meters, breadth, 1.5 to 2.

Holotype, female No. 51128. United States National Museum, Arisan central Formosa, altitude 2,300 meters, May 23, 1934; three paratypes, females, May 23 to 25, and a paratype, male. Taihezan, northeastern Formosa, altitude 1,800 meters, May 8, 1932, in the author's collection, all collected by the author.

This species differs from *P. filiformis* Fairm. in being smaller and less parallel, in having the antennæ finer and less hairy below, and the elytra acute apically and lacking longitudinal stripes.

Genus METOPOPLECTUS Gressitt novum

Frons trapeziform, head directed posteriorly below, antennæ very long, scape swollen apically, prothorax non-tuberculate anterior coxa, cavities closed behind, middle coxal cavities open exteriorly, tarsal claws moderately divergent, form only moderately elongate, narrow in fore body, shoulders prominent, elytra slightly narrowed posteriorly.

Head as broad as prothorax, subacute at apex, nearly twice as broad at genæ as at antennal tubercles, which latter are prominent and close, frons higher than wide, subparallel, eyes small, almost entire, hardly extending behind antennæ, supports not very finely faceted, genæ large, clypeus short, abrum with apical margin slightly concave, palp. with last segment of each pair narrowed and subacute apically. Antennæ two and two-thirds to three and one-half times as long as body, scape reaching nearly to posterior margin of prothorax, gradually swollen posteriorly, second segment about as long as broad, third to tenth subequal and nearly as long as first, last longer than two preceding combined. Prothorax cylindrical, one-fourth longer than broad, base hardly broader than apex, two-thirds as broad as elytra. Scutellum as long as broad, rounded behind. Elytra very slightly narrowed in basal three-fourths, apices fairly abruptly narrowed, and narrowly rounded or subtruncate, at suture. Abdomen with first segment not quite as long as following two, unteg. Legs short, femora moderately swollen, hind pair reaching to middle of abdomen, middle tibiae obscurely grooved exteriorly, tarsi nearly as long as tibiae, the hind pair with the first segment barely as long as the following two unteg, last longest.

Genotype.—*Metopoptectus taiwanensis* Gressitt sp. nov.

Range.—Formosa and eastern China.

This genus is established for the following new species, as well as for *Cleplemetopus orientalis* M. Toma and an undescribed species from China.

Differs from *Cleplemetopus* Thomson in being broader, in having the head shorter and less acute the frons broader the scape more swollen apically, the succeeding antennal segments lacking long apical hairs, the prothorax being less elongate and less narrowed apically, the elytra less attenuated, less heavily punctured basally, and not swollen posteriorly, their surface with concave areas, and from *Peltis* in having the superior lobes of eyes lacking, the antennae much less hairy the scape swollen, the prothorax narrower and the elytra shorter. The form is less linear than in most Hippophae, the elytra being considerably broader than the head and prothorax.

Hippophae *harmosinus* Gravell sp. nov. (Pl. 1, fig. 10)

Entirely dull chocolate-brown elytra partly very light brown, body clothed below with short grayish brown hairs and above with dark chocolate and light tawny brown hairs, front of head slightly reddish brown with a few pale hairs, thicker at sides becoming blackish brown with a narrow midlongitudinal stripe of tawny hairs, and similar clothing behind eyes; antennae with scape reddish brown on basal two-thirds, the apex blackish, remaining segments light brown basally, and dark chocolate-brown apically; prothorax with a median, and two lateral, broad, longitudinal, tawny stripes ventromedial tawny, elytra dark brown basally, a few obscure pale stripes extending from basal portion of disc, humerus, and lateral margin, converging and meeting suture before middle, then one obscure dark brown area irregular posteriorly and broader at suture, along which it extends posteriorly, joining one of two longitudinal subapical dark stripes, inner one not adjacent to suture, extreme apex dark, intervening postmedial and subapical areas pale brown.

Head fairly densely and finely punctured, not quite as broad near apices of genae as at eyes much narrower across antennal tubercles, eyes small, entire, very slightly longer than broad, rounded below and bluntly angulate above. Antennae three to three and one-half times as long as body, scape swollen apically very slightly longer than third segment, third to tenth subequal, not very long; five basal segments sparsely clothed below with short fine hairs. Prothorax barely longer than broad, very slightly swollen in middle, basal two-thirds as broad as elytra, surface fairly densely and finely punctured. Elytra very slightly narrowed in basal three-fourths, apices narrowly rounded at

suture; surface fairly densely, and moderately heavily, punctured in twelve or more rows, less heavily so posteriorly. Ventral surface moderately punctured, more heavily on sides of metasternum and more finely on abdomen. Length, 9.5 to 10.3 millimeters; breadth, 2.2 to 2.5.

Holotype, female, No. 81430, United States National Museum, Sakabén, northeastern Formosa, altitude 1,100 meters, July 16, 1934; allotype, male, Hori, central Formosa, at about 600 meters, June 9, 1934, in the author's collection, both taken by the author.

Differs from *Af. orientalis* (Milone) in its smaller size, its more swollen, and more arched, antennal scape, its less cylindrical prothorax, its rounded instead of subacute, elytral apices, and its strongly punctured metasternum. The elytra are also less densely punctured than in the latter.

Genus *ARISANIA* Greenlit novum

Elongate, parallel-sided, cylindrical; frons narrow, broadest at antennal tubercles, which are very prominent, antennae twice as long as body; pronotum with a small tubercle at each side; anterior coxae subglobular, separate, closed behind; middle coxal cavities open externally; middle tibiae grooved externally; legs short, hind femora nearly as long as first two abdominal segments, larval claws divaricate; elytra long, rounded-truncate apically.

Head as broad as prothorax, higher than wide, directed slightly posteriorly below; eyes moderately narrow and long, very narrowly constricted behind antennal supports, ventral lobe large, fairly closely approaching mandibles, dorsal lobe minute, antennal tubercles large and very prominent, contiguous basally, diverging at an angle of 100°, frons higher than wide, broadest at antennal supports, subparallel below, swollen, clypeus short; labrum longer than clypeus, more than half as long as broad, punctulate, mandibles short, very thick basally, genae minute, palpi with the apical segment of each pair subfusiform, thickened basally and truncate apically. Antennae two and one-half times as long as body in male, twice as long in female, scape reaching to about middle of prothorax, subcylindrical, narrow at base, thickest before apex, external apical margin slightly emarginate, second segment broader than long, third to seventh segments subequal, cylindrical, progressively slightly longer and finer, last four segments shorter and finer, last longer than tenth, shorter than third. Prothorax as long as broad, broader at apex than at base, slightly constricted before the base, furnished with a

short, conical tubercle at each side slightly behind middle a slight swelling behind middle of disc, middle of posterior margin raised. Scutellum nearly as long as broad, rounded truncate behind Elytra long, parallel slightly constricted before middle, very slightly narrower and subobliquely truncated at apex, surface subseriate-punctate. Anterior coxae prominent, subglobose, their cavities angulate externally, closed behind middle coxae less prominent, their cavities open externally to epiphysa, metasternum swollen at sides and abruptly decurrent apically, metepisternum narrowed posteriorly. Abdomen with last segment as long as first, second, third, and fourth successively shorter. Last segment slightly emarginate below at apex in male concave apically, half in female. Legs short, femora moderately swollen, tarsi as long as tibiae, first segment of hind pair not as long as following two segments combined, claws divaricate.

Genotype—*Arisania submarmorata* Gressitt sp. nov.

Range.—Formosa (central).

This genus is doubtfully placed in the Hippopsini, differing from the characteristic genera in having the frons narrowed apically, the antennae not ciliate below, except for scape, the prothorax with a small tubercle at each side, and the tarsal claws divaricate. Differs in form from *Pseudocalamobius* in being broader and more cylindrical with the antennae thicker, and shorter in the male.

ARISANIA SUBMARMORATA Gressitt sp. nov. Plate II, fig. 16.

Elongate, parallel, elytra two and one-half times as long as head and prothorax united, frons narrowed apically, antennae tubercles prominent, prothorax slightly tuberculate laterally, hind femora hardly reaching to end of second abdominal segment.

Reddish brown blackish in front of head, middle of prothorax and ventral surface of body, body largely covered with short, recumbent brown hairs, forming mottled patterns. Antennae poorly clothed, scape only with very short fine erect hairs below, head, prothorax and scutellum with light rusty brown hairs, a large irregular patch in middle of disc of latter, elytra with a small, irregular subbasal discal spot and the apical third largely light rusty brown, a short transverse hairless band preceding the latter area, anterior three-fifths thus and irregularly clothed with small spots of grayish brown hair, ventral surface grayish brown, sides of metathorax apical segments, and sides

of basal segments, of abdomen irregularly rusty. Length 7.5 to 10.5 millimeters, breadth, 1.5 to 2.5.

Holotype, male. No. 51431, United States National Museum, Arisan, Formosa, altitude 2,250 meters, June 1, 1932, allotype female, and 3 male paratotypes in the author's collection, all taken the same day by the author.

The middle portion of each antenna segment is pale in the female.

Genus *OBEREA* Mulsant, 1839

OBEREA BREVITHORAX Gressitt sp. nov. Plate 1 fig. 1²

Elongate, prothorax short, elytra long, narrowed after base, third and slightly expanded preapically, head and antennae pitch black, except for amber-colored clypeus and pale orange palpi, prothorax pale orange below, darker orange above with a very small black spot at each side near base, scutellum brownish black, elytra grayish black along suture and shiny black on shoulders, sides, and apices, yellow on middle of basal margin and with a wavy brown stripe along middle of disc to near apex, dotted with black punctures, subhumeral areas orange, ventral surface orange, except for black metepisternum, posterior three-fourths of metasternum, lateral margin of first, sides of second and third, and all but base of fifth abdominal segments, hind tibiae, external margins of anterior and middle tibiae and tarsi above except for base of third segment and large part of last which is brown. Forebody and underside clothed with short, recumbent hairs and longer and sparser erect pale or golden hairs, those on last abdominal segment and the erect ones on head black, elytra with pale recumbent hairs on inner black portion and some erect ones on basal portion, the brown stripe nearly naked, shiny.

Head strongly swollen in front very slightly concave on vertex, fairly heavily punctured except on posterior portion of occiput, eyes large, deeply constricted, ventral lobe broader than dorsal, closely approaching mandibles. Antennae (female) reaching to last fifth of elytra, all segments except second subequal in length. Prothorax very short, two-thirds as long as broad, hardly as broad as elytra at base, swollen above and with a raised area at each side surface irregularly punctured, more sparse on center of each. Scutellum short, its posterior margin transverse. Elytra fully four times as long as head and prothorax united, narrowed and subparallel after first quarter, slightly expanded in last fifth, apices oblique and emarginate laterally with a small tooth at suture and a larger one at exterior

tal angle surface with six longitudinal rows of large punctures. *Mesepis ermin* moderately punctured, narrowed and raised above, metepisternum slightly punctured, metasternum punctured moderately at sides, more finely anteriorly, abdominal segments slightly punctured at sides. Legs short, hind femora reaching but slightly beyond end of first abdominal segment. Length, 19 millimeters, breadth, 2.5.

Holotype, female California Academy of Sciences, Hori Formosa, altitude 500 meters, June 9, 1934, collected by the author.

This species differs from *O. bistrigatus* Pic in having the prothorax short, the elytra much more attenuate, more oblique at the apices, more heavily punctured, relatively naked and partly brown, and the last abdominal segment shiny black except at base. It differs from *O. holozantha formosana* Pic in having the head broader, the prothorax much shorter and the elytra more attenuate besides being largely black and brown.

JAPANESE NAMES

1. *Aromia faldermanni formosana* subsp. nov. Kaki-ubane-kamikiri.
2. *Chlorodolum locheoanum* aeneum subsp. nov. Ta-wai-tora-kamikiri.
3. *Kuraruva consanguis* gen. et sp. nov. Kuraru-hosobane-kamikiri.
4. *Merionoides traevensis* Kano. Iwa-momobuto-bana-kamikiri.
5. *Merionoides formosana* Heller. Momobuto-bana-kamikiri.
6. *Xylotrechus rufipennis* sp. nov. Akamon-tora-kamikiri.
7. *Perissus gyratus* sp. nov. Usuao-tora-kamikiri.
8. *Raphuma notabilis* sp. nov. Sakanen-tora-kamikiri.
9. *Demonax matsuishi* sp. nov. Matsushita-tora-kamikiri.
10. *Chlorophorus demonacoides* sp. nov. Suisha-tora-kamikiri.
11. *Chlorophorus miwai* sp. nov. Miwa-tora-kamikiri.
12. *Bunetnorox* gen. nov. takasagoensis (Kano) Takasago-bana-kamikiri.
13. (?) *Savina hirticornis* sp. nov. Kehigo-gomafu-kamikiri.
14. *Pseudocalamobius impressus* sp. nov. Kōzuki-dōso-kamikiri.
15. *M. toropectus formosana* gen. et sp. nov. Hime-ebicha-r-genaga-kamikiri.
16. *Aristonua submarmorata* gen. et sp. nov. Arisan-higenaga-kamikiri.
17. *Obereus brevithorax* sp. nov. Tankou-ringo-kamikiri.

ERRATUM

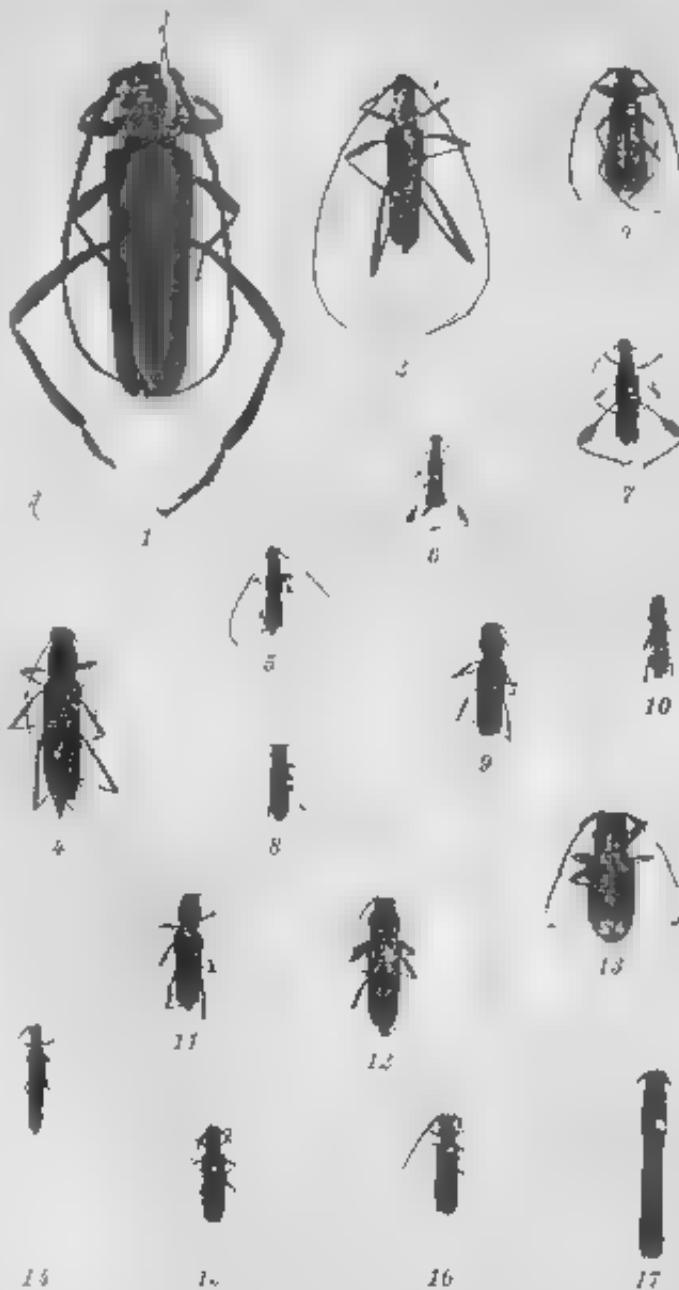
In the preceding paper of this series, Phil. Journ. Sc. 58 (1935) 243-266 v. pages 249, 260, and 266, the genus should read *Anoploderomorpha*, instead of *Anoplodermorpha*.

ILLUSTRATION

PLATE 1

(Magnified 15 times.)

1. *Aromia felderiensis* subsp. *inundata* Grossitt nov., holotype.
2. *Chloridium rochebonum* sp. nov. tenuicorne Grossitt nov. holotype.
3. *Biotrichoma* (gen. nov.) *teknasorum* (Kuno) Ta Nelson Formosa.
4. *Raphiaea notabilis* Grossitt sp. nov. holotype.
5. *Neomaria contractaepennis* Grossitt gen. et sp. nov., holotype.
6. *Morionoda uratensis* Kano, Bulai Formosa.
7. *Morionoda formosana* Hsieh, Hsinchun, Formosa.
8. *Perissia grisea* Grossitt sp. nov. holotype.
9. *Xylotrechus rufanotatus* Grossitt sp. nov., holotype.
10. *Demonax matanensis* Grossitt sp. nov., holotype.
11. *Chlorophorus demonaxoides* Grossitt sp. nov. holotype.
12. *Chlorophorus subtruncatus* Grossitt sp. nov., paratype. Ilor Formosa.
13. (?) *Sabina hirsutornis* Grossitt sp. nov., holotype.
14. *Proctoceraumulata* sp. nov. Grossitt sp. nov. holotype.
15. *Metopoplatus taiwanensis* Grossitt gen. et sp. nov., holotype.
16. *Aristia subminuta* Grossitt gen. et sp. nov. holotype.
17. *Oberes brevithorax* Grossitt sp. nov., holotype.



NEW OR LITTLE-KNOWN TIPLIDIÆ FROM EASTERN
ASIA (DIPTERA) XXXII

By CHARLES F. ALEXANDER

Of Amherst, Massachusetts

TWO PAGES

Virtually all of the species of crane flies herein discussed are from the tea plantations where they were collected in 1925 by Mr. J. T. Sibley Gressitt. A few additional species are from the Khasi Hills, Assam, section of Mr. S. S. Bhatia's collection of *Catomolomidae*. As the types of novelties described at this time are preserved in my very extensive collection of these flies, I wish to express my deepest thanks to the above-mentioned entomologists for their friendly cooperation in connection with a study of the Tipulidae of southeastern Asia.

The rather extensive collections made in Huai-hai proved to be of exceptional interest since virtually nothing had been made known of this insect fauna area. I am indebted to Mr. Gressitt for the following notes concerning various collecting stations at which Tipulidae were secured:

TA HIAN. Altitude 2,000 feet by stream on northwestern foot of the Five Finger Mountains, south of the village of Cho-sang, 1 km. east of Fan Heang.

TA HAN. Altitude 2,500 feet small valley between passes of the Loi Mother Ranges and the Red Mist (Hong Moi) Range, on road from Nodoa to the Five Finger Mountains, about 20 miles west of Ta Hian.

TA HAI. Altitude about 900 feet, a small village near the Lou-ti Dam Chu-tze and slightly south of Nodoa about 30 km. flat country.

NOHIA (NODA). Altitude about 1,000 feet flat country in the northeast-central part of the island.

PAN TA. Altitude about 1,250 feet 22 miles south of Nodoa, beyond a range of low mountains.

CHI NG KON. Altitude about 1,600 feet between Nodoa and Lo Motuer mountain near Dergung River.

*Contribution from the entomological laboratory, Massachusetts State College.

DWA BI (TAI PIN) Altitude about 1,500 feet, at foot of north end of Loi Mother Range, about 20 miles west and slightly north of Liamui, near the center of the island.

LIAMUI Altitude about 1,200 feet, near the eastern edge of mountain, on a low plateau, with mountains on its east between it and the great northern plain. From the hills around can be seen the Loi Mother Mountain, Red Mist Mountain, and the Five Fingers, to the west and southwest.

Besides the score of species of *Tipulidae* described as new in the present report, Mr. Gressitt secured a number of additional crane flies that are recorded herewith to complete the data.

LIMONIA ERIPIDIA PLICHTA de Meijere

Ta Hian, June 13, 1935.

LIMONIA GERANOMYIA ARCENTIFERA de Meijere

Ta Hian, June 14, 1935, Ta Hau, June 7, 1935, Liamui, June 31, 1935.

LIMONIA THYPTICOMYIA APICALIS Wiedemann

Ta Hian, June 11, 1935, Ta Han, June 22 and 23, 1935

CONOSIA PRORATA Wiedemann

Ta Hian, June 15 to 18, 1935, Ta Hau, June 22 to 24, 1935, Ta Hau, July 3, 1935, Nodoa, June 30, 1935, Chung Kon July 17, 1935.

TRENTEPOLIA (MONGOMIA) PENNIPES (Osten Sacken)

Chung Kon, July 18, 1935

TRENTEPOLIA (TRENTEPOLIA) PICTIPENNIS Bequaert

Ta Hian, June 11, 1935, Ta Han, June 21, 1935

TRENTEPOLIA (TRENTEPOLIA) TRENTEPOLII (Wiedemann)

Ta Hian, June 11, 1935, Nodoa, June 20, 1935, Liamui, July 2, 1935, Ta Hau, July 4, 1935, Chung Kon, July 18, 1935, Dwa Bi, July 21, 1935

GONOMYIA (LIPOPHLEPS) BICOLORATA Alexander

Ta Hau, June 23, 1935 Known hitherto only from Luzon

GONOMYIA (LIPOPHLEPS) INCOMPLETA Brunetti

Ta Hian, June 14, 1935, Ta Hau, July 3, 1935, Chung Kon, July 18, 1935, Dwa Bi, July 20, 1935

TIPULINÆ

LONGURIO HAINANENSIS sp. nov. Plate I fig. 1

General coloration of mesonotum and abdomen yellow and orange, head variegated with brownish black on lateral por-

lens of posterior vertex wings narrow tinged with gray. Rs short and arcuate, much shorter than R_5 , near a short distance before fork of M_2+3 .

Female. Length about 20 millimeters, wing, 10.

Frontal prolongation of head below white, wings conspicuously black, palps black. Antennae dark brown throughout very small, faint backward scarcely extending beyond the posterior border of head flagellar segments cylindrical, with inconspicuous verticis. Head whitish on front and anterior vertex, the central portion of posterior vertex and occiput yellow, the lateral portions of latter, together with the posterior a little brownish black.

Pronotum and propleura black. Mesonotum almost uniform yellow, restrictedly variegated by darker including the lateral ends of sutural margins of parascutella, and posterior border of mesonotum. Pleura obscure yellow the posterior border of dorsopeneral membrane with a conspicuous velvety black area, posterior portion of pleuroterga a little darkened. Halteres dirty white, the knobs darkened. Legs with the coxae yellowish testaceous, trochanters whitened, remainder of legs brownish black. Wings (Plate 1, fig 1) narrow and pointed with a faint grayish tinge, stigma and cell Sc a little darker than brown. Macrotrichia on outer portions of veins R_3 and R_{4+5} , trichia on outer medial branches lacking or reduced to one or two scattered setae. Variation: Rs short and arcuate, much shorter than R_5 , distal end of Sc , atrophied, near a short distance before fork of M_2+3 , cell 2d A relatively wide.

Abdominal tergites orange-yellow the measures restrictedly paler, intermedate tergites with vague reddish darkening, on outer segments more evident and suffusing the caudal borders of the segments, sternites more yellowish, with a more or less distinct brown median stripe, pleural membrane infuscated. Ov. position with small and inconspicuous blunt rashes.

Habitat—China (Hainan Island).

Holotype, female, Dwa Bi, a latitude about 1,300 feet, July 20, 1935 (Gressitt).

Longuia hainanensis is readily told from the four species hitherto described from China and Japan by the narrow, subhyaline wings, with Rs unusually short and arcuate. The most similar of the above-mentioned forms is *L. jucunda* Edwards (Chia Formosa). I am not fully convinced that *Sphaerionothrix* de Meijere can be maintained as a genus distinct from *Longuia* Loew.

NEMBOTHONIA RAYFANICA sp. nov. Plate I, fig. 2

General coloration yellow, patterned with black, frontal prolongation of head darkened on sides; head orange, with no occipital brand, mesonotal prescutum with three polished black stripes that are narrowly bordered by velvety black, the central portion of median stripe paler on anterior half, scutellum, postscutum, and pleura yellow; wings with a faint dusky tinge, the stigma and cells Sc and Cu₁ darker, Sc₁ ending a short distance beyond origin of R_s, the latter subequal in length to R₂₊₃, cell M₁ broadly sessile; abdominal tergites weakly infuscated medially, the disk of the seventh tergite intensely blackened.

Female—Length, about 14 millimeters, wing 11.

Frontal prolongation of head light yellow above, dark brown on sides, nasus black, conspicuous. Antennae with the scape brown, pedicel dark brown, flagellum black. Head orange, vertical tubercle very weakly notched, no differentiated occipital brand.

Pronotum and pleura orange-yellow. Mesonotal prescutum yellow with three polished black stripes, all narrowly bordered by velvety black, anterior end of median stripe with its central portion yellow, this pale color continued caudad for nearly one-half the length of the stripe; lateral stripes straight, scutum yellow, each lobe with two confluent polished black areas that are very narrowly bordered by velvety black, lateral ends of transverse suture infuscated, scutellum and mediotergite yellow without darkening, the latter with delicate setulae on posterior lateral portions. Pleura yellow, variegated by more reddish yellow areas on the propleura, anepisternum, ventral sternopleurite, and meron. Halteres dusky, the base of stem reddish pale. Legs with the coxae and trochanters yellow, the fore coxae more reddish yellow; femora brownish yellow, somewhat clearer yellow at base, a little more darkened outwardly, tibiae and tarsi brownish black to black. Wings (Plate I, fig. 2) with a faint dusky tinge; stigma cell Sc₁ and the narrow cell Cu₁ infuscated, wing tip very gradually and insensibly darker than the remaining ground color of the membrane, veins dark brown. Stigmal trichia few. Venation: Sc₁ entirely preserved, Sc₂ ending a short distance beyond the origin of R_s, the latter subequal in length to R₂₊₃, cell M₁ broadly sessile, in caudal point of departure of vein M₂.

Abdominal tergites weakly infuscated medially, somewhat paler sublaterally at bases of segments, disk of seventh tergite intensely blackened, the borders yellow, the lateral margins more broadly

so sternum more uniformly yellow. Ovipositor with genital shield obscure yellow, cerci nearly straight.

Habitat. China (Hainan Island).

Holotype. female Ta Han, altitude 2,500 feet, June 22, 1935 (Greaves).

The thoracic pattern especially the highly polished praescutal stripes that are narrowly margined with velvety black is much as in *Leptotarsus sinensis* Edwards, which differs conspicuously in the occipital band, dark on the praescutal area, and black streaks on and apical half of mesocercite, and numerous other features. The coloration of the mesalar praescutal stripe is approached by the otherwise very different Formosan species, *Aparia* Edwards.

CYLINDROTOMINAE

PHALACROCEA TARSALIS sp. nov. Plate I, fig. 3.

Front and anterior vertex silvery white, posterior vertex black, prothorax light yellow, mesonotum almost uniformly black, pleura yellow, legs blackened, the tarsi evenly snowy white, wings narrow, the praecarinal region petiolate, mesal at fork of M, etc. 2d A reduced to a narrow strip, abdominal tergites black, the sternites more greenish, lower, ovipositor and genital segment brownish yellow.

Female. Length, about 8 millimeters, wings, 8.

Rostrum yellow, palps dark brown. Antennae relatively short, scape and pedicel yellow, flagellar brownish black, flagellar segments passing into a anal lobe, with vertices that much exceed the segments, terminal segment about one-half longer than the penultimate. Front and anterior vertex broad, silvery white, posterior vertex black, the latter ranging to brownish yellow.

Prothorax entirely light yellow. Mesonotum a most uniformly black, greatly obscuring the obscure yellow ground colors, praescutum with three convergent stripes, the yellow ground reduced to narrow, numerous triangles, median regions of scutum and scutellum restrictedly pale, mesal to pale narrow, margined with yellow, the disk black. Pleura and penultimate together with the pleural membranes, uniformly pale yellow. Halteres dusky, the knobs infuscated, the base of stem restrictedly yellow. Legs with the coxae and trochanters yellow, femora greenish, usually the tarsus grayish, passing into brownish brown, the tips darker, tarsi snowy white, the proximal ends of 2d tarsa blackened. Antennae detached and the degree of blackening varies in the various legs in some, only

the extreme tip, the distal fifth or sixth, is whitened, while in one pair which is presumably the posterior one, the white includes the distal three-fifths.) Wings (Plate 1, fig. 3) with a weak brown tinge, stigma small, long-oval dark brown, veins dark brown, the prearcular veins more yellowish brown. Wings with a long basal petiole. Venation Sc atrophied, Sc ending just beyond fork of Rs, the free tip evident as a faint trace at near midlength of the stigma, m-cu at fork of M, cell 2d A reduced to a narrow strip.

Abdominal tergites black, sternites more greenish brown, ovipositor and genitalia segment brownish yellow.

Habitat.—China (Hainan Island).

Holotype, female Ta Hainan, a titude 2,500 feet, June 25, 1935 (Gressitt). Paratotypes 1 female, 1 (sex?), June 21 and 22 1935.

Pholacrocera tarsalis is readily told from all other allies in eastern Asia by the unusually narrow, petiolate wings, very narrow cell 2d A, and the snowy white tarsi. It has no close relative so far made known, the most similar form being *P. microstoma* Alexander (western China). The discovery of a Palearctic element such as the genus *Pholacrocera* at relatively low altitudes in Hainan has provided a surprise in geographic distribution.

LIMONIINAE

LIMONIA

Genus LIMONIA Meigen

Limonia MEIGEN in J. gen. Morphol. 2 (1803) 262

Subgenus GROSSITOMYIA novum

Characters as in typical *Limonia*, differing most evidently in details of wing venation.

Abdomen 15-segmented, flagellar segments oval, the longest vertex of, evenly distributed on outer face, about one-third longer than the segments, terminal segment slender about two-thirds the length of the petiolate. Anterior vertex narrower than the diameter of the scape. Caws with a single short spine near base. Wings (Plate 1, fig. 4) with Sc moderately long, Sc and R₂₊₃ beyond two-thirds the length of Rs. Sc close to its tip, Sc₁ R gradually bent strongly caudad, at its outer end receiving vein R₄₊₅ to a short point, and then diverging to the free tip of Sc, correspondingly lengthened but entirely pale a superimposed cross vein near R₂₊₃ at near midlength, vein R₃ beyond the cross

vein strongly sinuous, slightly constricting cell R_5 at near mid-length, a long fusion of veins R_{4+5} and M_2 , nearly equal in length to R_5 , completely obliterating r_m , cell 1st M_2 narrowed to a point at outer end m being very short to nearly obliterated, outer median veins deflected strongly caudad, $m-cu$ at or close to fork of M_1 , cell M_1 at margin unusually wide, anal veins nearly straight, parallel at origin. Male hypopygium (Plate 2 fig. 25) with the dorsal distystyle, *dd*, well developed slender. Ventral distystyle, *vd*, small, with a long slender, rather prolongation that bears two, long, slender spines on a small tubercle at base, face of style bearing a larger and more conspicuous tubercle that has three, very long, slender setae, these exceeding in height the ventral prolongation of the style.

Type of species *Leucostoma (Greavesiella) receptum* sp. n. (Oriental Region, Eastern China, Hainan Island.)

The crane fly discussed under the above name is one of the strangest in appearance that has ever come to my attention. At first sight the venation seems quite irreconcilable with that of members of the genus *Leucostoma* the veins beyond the end being unusually complicated by fusions of elements and the presence of a supernumerary crossvein in cell R_5 . However, there is no doubt that the fly is a member of the great genus *Leucostoma* and that it is necessary to erect a new subgeneric group for its reception. I take great pleasure in dedicating this subgenus to Mr. J. Linley Greaves, who has added materially to our knowledge of the Tipulidae of eastern Asia.

The most unusual character of the group and the one that separates it from all other subgenera of *Leucostoma* is the profound fusion of veins R_{4+5} and M_2 , a character suggested by certain other species of the genus, as *Leucostoma (Leucostoma) gloriosum* (Edwards) where the contact of veins R_{4+5} and M_2 is merely punctiform. Elsewhere in the Tipulidae such a long fusion of veins R_{4+5} and M_2 is rare, being most evident in the tipuline genus *Philyppea* Westwood and in the leucostomatine genus *Trentepohlia* Bigot. In other groups of the Leucostomatinae, a fusion of this nature occurs sporadically in genera such as *Helina* St. Fargeau and *Tachinolabis* Osten Sacken but throughout the entire family Tipulidae its occurrence must be held to be decidedly uncommon. The presence of a supernumerary crossvein in the outer radial field is a character likewise possessed by three other subgenera of *Leucostoma*, namely *Leucostoma* *Edwardsi* *Dapunoptera* Westwood, and *Neoleucostoma* Alexander. The group must surely be held to

Gressittomyia would seem to be *Luosa*. For additional details and comparisons the discussion of the subgenera of *Limonia* as given by the writer in an earlier paper¹ may be consulted.

LIMONIA GRESSITTONYIA SP. NOV. Plate 1, fig. 4. Plate 2, fig. 2.

General coloration orange, antennae with scape and pedicel black, the flagellum obscure yellow, the outer segments more darkened; head silvery gray, with a narrow dark line on posterior vertex; halteres yellow, the knobs dark red, legs yellow, the femoral tips rather broadly blackened, wings hyaline, the prearcular and costal fields more yellowish, the outer radial, cubital, and anal fields more buffy, vein R_5+6 extensively fused with M_2 , M_1 very short to virtually lacking; male hypopygium with the rostral spines slender, from a common tubercle at base of prolongation.

Male.—Length, about 7 millimeters; wing, 8.2.

Rostrum and palpi black. Antennae with scape and pedicel black. Flagellum obscure yellow, the outer segments passing into brownish yellow; antennal structure as described under subgenus. Head silvery gray, with narrow black median line on posterior vertex.

Entire thorax orange, immaculate. Halteres yellow, the knobs dark brown. Legs yellow, the femoral tips rather broadly black, the amount subequal on all legs; outer (arcal) segments infumated. Wings (Plate 1, fig. 4) hyaline, the prearcular region and cells C_2 and R_5 light yellow; outer portion of cell R_5 , cell 1st M_1 , and base of R_5 , with outer ends of cells Cu , 1st A_1 and 2d A_1 , together with basal portion of C_2 more buffy, veins beyond cord narrowly but conspicuously veined with brownish black, veins black in the outer fields, paler in the cells basad of cord. Venation as described under the subgenus, second section of vein R_5+6 subequal in length to the second section of M_2 . Vein Cu lying unusually far distant from vein Cu_2 .

Abdomen, including hypopygium deep orange, the pleural membrane weakly infumated, ventral dististyle of hypopygium infuscated. Male hypopygium (Plate 2, fig. 23) with the caudal margin of tergite 9t, transverse, very gently emarginate, the setae at and near border dististyle, d , with ventromesal lobe large. Dorsal dististyle, dd , a slender thickened hook, the acute tip slightly decurved. Ventral dististyle, vd , with the body small, shorter than the dorsal dististyle, dv rostral prolongation long

¹ Philip. Journ. Sci. 40 (929) 239-248.

and slender. Mesal-apical lobe of gonapophyses very slender. Aedeagus broad at base, narrowed to the blubbed apex.

Habitat—Ching (Hainan Island).

Holotype, male, Tu Hua, altitude 2,500 feet, June 22, 1936 (Gressitt).

The species requires no comparison with any other known member of the genus.

*Table 112. *CHINOTIPULA LARABONICA* sp. n.* (Plate 1, fig. 5.)

General coloration obscure yellow. The proscutum darkened medially, flagellar segments gradually lengthened to the outermost; eyes broadly contiguous, ommatidia relatively complete, obscure yellow, the tips black, wings cream-colored, the base and costal portion cream-yellow, a restricted dark pattern, including the anal lobe, situated at origin of R_4+5 , very long, the rufous and short apiculus and short apiculus at origin, mixed at fork of M , and wing convergent basally. Abdominal legs tea light brown, apices of cerci, purple.

Female.—Length, without 7 millimeters; wing, 6.8.

Rostrum brown, base a little darker. Antennae dark brown throughout, basal flagellar segments short oval, the others passing through oval to subtriangular, becoming progressively longer outwards, terminal segment pointed on distal edge, about a fifth longer than the penultimate, extreme apex of flagellar segments glaucous and forming a pedicel, but not suddenly narrowed into a neck, verticils of outer rostrum brownish, 10 or a little longer than the apiculus. Eyes broadly contiguous on anterior vertex, ommatidia at very large and coarse, pale, no vertex brownish gray.

Pronotum brown. Mesonotal proscutum obscure yellow, more infuscated medially, lateral at posterior site of scutellum evident; scutellum infuscated and unusually one proscutum with a weak median impressed line, best developed on posterior half, scutellum dark brown, medians with obscure yellow, scutellum obscure yellow on basal portion, the posterior margin broadly infuscated weakly pronotum and intermediate dark brown, paler on lateral portions. Pleura obscure yellow, the propodeum, mesepisternum, and dorsal sternopleurite slightly infuscated. Lateral pale basally, the outer end of stem and the knobs infuscated. Legs with the coxae and trochanters testaceous yellow, femora yellow, the tips rather broadly and conspicuously blackened, tibiae yellowish brown, the tips narrowly at a gradually darkened, tarsi passing into brownish black. Wings (Plate 1,

fig. 5) with the ground color somewhat creamy, the prearcular region and cells C and Sc clearer yellow; stigma subcircular, brown, a very restricted, scarcely evident, dark pattern, appearing as small clouds at origin of Rs and fork of Sc , and as a very narrow and vague apical darkening; cord and outer end of cell 1st M_2 very slightly darkened, most evident as a deepening in the intensity of the veins; veins yellow, darker beyond cord and in the clouded areas. Venation: Sc relatively long, Sc_2 ending about opposite four-fifths the length of Rs , Sc_2 near its tip, Rs weakly angulated and spurred near origin, free tip of Sc_2 and R_2 in transverse alignment; cell 1st M_2 widened outwardly, in about one-half the basal section of M_2 ; m-cu at fork of M_2 , anal veins convergent basally, 2d A very gently sinuous.

Abdominal tergites light brown, scarcely variegated with darker; sternites more yellowish. Ovipositor with valves reddish horn-color, the bases of the hypovalvae blackened, cerci up-curved and acute at tips.

Habitat.—China (Hainan Island).

Holotype, female, Dwa Bi, altitude about 1,500 feet, July 22, 1935 (Gressitt).

The general appearance of the present fly indicates that it is a member of the *pendleburyi* group. It differs from the typical form of this group, *Limonia (Limonia) pendleburyi* Edwards, of the Federated Malay States, and allied species, in the coloration of the body, legs, and wings and in the details of venation. The angulated and spurred Rs is a peculiar feature in the present group of flies.

LIMONIA (LIMONIA) QUINQUE-COSTATA, sp. nov. Plate I, fig. 6.

General coloration brownish yellow, the praescutum with four darker brown stripes; antennae black throughout; thoracic pleura brownish yellow, variegated by blackened areas; knobs of halteres dark brown; femora brownish black, the tips narrowly and abruptly yellow, tibiae and tarsi black, wings cream yellow, with a restricted dark pattern, including five small areas along costal border; free tip of Sc_2 and R_2 in approximate transverse alignment, anal veins strongly convergent; cerci bidentate at tips.

Female.—Length, about 10 millimeters; wing, 9.

Rostrum obscure brownish yellow; palpi black. Antennae black throughout; basal flagellar segments globular, passing through short-oval to elongate; terminal segment about one-half longer than the penultimate; longest verticils exceeding

the segments. Front and anterior vertex buffy, the posterior portion of head more fulvous, anterior vertex reduced to a narrow strip that is only a little wider than the diameter of a single ommatidium.

Pronotum dark brown above, brownish yellow on sides. Mesonotal preacetum brownish yellow, the humeral region clear yellow, four darker brown preacutal stripes, the intermediate pair entirely confluent on anterior third of sclerite; a narrow blackish area borders internally the yellowish humeral portion of sclerite, acutal lobes dark brown, the median region more grayish, acetulum pale, mediotergite light gray, a trifle paler medially, more darkened on sides. Pleura brownish yet low, variegated by blackened areas on ventral propleura, dorsopleural membrane, ventral anepisternum, and dorsal sternopleurite. Halteres relatively long, the stem yellow, the knob dark brown. Legs slender, fore coxae dark brown, the middle and hind coxae yellow, femora obscure yellow basally, gradually deepening to brownish black, the tips narrowly but conspicuously yellow, the amount subequal on all legs; tibiae and tarsi black. Wings (Plate I, fig. 6) with the ground color cream yellow, with a restricted brown pattern that is confined to the vicinity of the veins, including a series of five costal areas, distributed as follows: Areas, cell Sc at near one-third the distance to Rs ; origin of Rs , fork of Sc ; and the small circular stigmal area on vein R_{2+3} , only slightly invading R_5 ; additional dark seems to many of the veins, including the cord, outer end of cell 1st M_2 , more than the basal half of vein R_{2+3} , and outer end of vein 2d A ; veins yellow darkened in the clouded areas. Venation: Sc , ending beyond level of $m-cu$, Sc at its tip, its very gently arcuated about four times the basal section of B_{1+2} , free tip of Sc , lying shortly proximal of M_2 , cell 1st M_2 of moderate length; m and basal section of M_2 subequal, $m-cu$ at near one-third the length of cell 1st M_2 , outer radial and marginal veins nearly straight or only gently curved, anal veins strongly convergent.

Abdominal tergites chiefly dark brown, the caudal portions of the segments a little more reddish brown, sternites brighter. Cerci stout, bidentate at tips.

Habitat.—China (Hainan Island).

Holotype, female Ta Huan, altitude 2,300 feet, June 21, 1935 (Cressitt).

By Edward's key to the species of *Leptotes*, the present fly fits to couplet 33, differing markedly from all species in the wing pattern and leg coloration. It runs more or less directly to *L. monica* (Tabnotes) long nerves (Br. test) an entirely different species.

ANTO HA ANTOLHA PLATYDELA sp. nov. Plate 1, fig. 4. Plate 2, fig. 26

Size small, wing male, 3.5 millimeters; head light gray; antenna short, flagellum black, thorax and abdomen light yellow, halteres pale yellow, femora yellow, the tips narrowly infuscated, wings cream-colored, with a restricted pale brown clouded pattern men more than one fourth its length before the fork of M, male h. poppygium yellow, the outer dist style suddenly narrowed at apex into an acute black spine.

Male. Length about 3.5 millimeters, wing, 1.5.

Rostrum obscure yellow, palpi a trifle darker. Antennae short, scape and pedicel yellowish brown, flagellar segments smooth, subglobose to short-oval, the outer ones becoming more elongate. Head light gray.

Entire thorax light yellow. Halteres pale yellow. Legs with the coxae and trochanters yellow, femora yellow, the tips narrowly and gradually infuscated, tibiae pale brown, the tips slightly darker, tarsi infuscated. Wings (Plate 1, fig. 7) cream-colored with a vague but evident pale brown pattern, distributed as clouds at origin of Rs, at gma. along cord and outer end of cell 1st M and at the outer ends of veins R_5 and 1st A, veins yellow pale brown in the clouded areas. Veins lch and R entirely glabrous. Venation relatively long, Sc ending some distance beyond the fork of Rs , R , M in lateral transverse alignment with r_m cell 1st M about as long as r_m M beyond it, basa section of M longer than r_m men more than one-fourth its eng. before the fork of M .

Abdomen pale yellow, poppygium yellow. Male h. poppygium (Plate 2, fig. 26) with the tergite narrowed, transverse, the caudal margin approximately straight across or with the median portion a little produced. Outer dist style, on relatively long and slender, at apex suddenly narrowed into an acute darkened spine. Inner dist style broader, the apex obtuse. Phallosome p subtended on either side by a flattened very pale plate, the apex of which is obtusely rounded. Outer gonapophysis, g , a simple slender rod, gradually narrowed to an acute point.

In ait. China (Hainan Island).

Molotype, male, Dua Bi, altitude about 1,500 feet, July 21, 1935 (Gressitt).

The present species is most closely allied to *Antocha* (*Antocha*) *farinella* Edwards and *A. (A.) nebulae* Edwards, both from the Malay Peninsula, differing in the gray coloration of the head, color of the antennae uniformly yellow thorax and abdomen, darkened femoral tips, and details of pattern of the wings. In the last mentioned regard, the fly is more like *nebulae*, which in all other respects is very distinct.

ANTOCHA (ANTOCILA) KHANGYET n. sp. (Plate 1, fig. 42; Plate 2, fig. 27)

General coloration pale yellow, the transverse suture of mesonotum narrowly darkened; antennae yellow, legs yellow, the tips of femora rather narrowly but conspicuously blackened, wings mainly white, patterned with brownish black, including the prearcular field and subcostal cell as far distad as the level of origin of R_5 , costal and outer end of cell 1st M , narrowly seamed with dark, m-cu more than its own length before the fork of M , male hypopygium with the outer dististyle obtuse at apex, inner gap, nephritis acutely pointed, with a pale lateral flange.

Male.—Length about 3.5 to 3.7 millimeters, wing, 4 to 4.4

Female.—Length, about 3.5 millimeters wing 4

Rostrum yellow; palpi scarcely darkened. Antennae short, yellow, the outer flagellar segments a trifle darker, flagellar segments oval. Head yellow

Mesonotum pale yellow, the suture narrowly dark brown, the pattern a little more expanded at lateral ends. Pleura pale yellow. Halteres pale yellow throughout. Legs yellow, the tips of the femora narrowly but conspicuously blackened, the amount unequal on all legs, in the allotype the femora are somewhat less extensively darkened, tibiae more narrowly darkened at tips; tarsi, yellow, the outer segments darker. Wings (Plate 1, fig. 8) mainly white, patterned with brownish black, in the costal field the latter color alternating with brighter yellow areas, most evident on the costal vein before and beyond the dark stigma, prearcular field and cell Sc as far distad as the origin of R_5 blackened, costal and outer end of cell 1st M , seamed with blackish; veins pale darker in the clouded areas, including the outer medial veins. Venation: R_5 only a little longer than R_4 , the latter lying far before the level of $r.m.$, m-cu more than its own length before the fork of M .

Abdomen, including hypopygium, yellow. Male hypopygium (Plate 2, fig. 27) with the outer dististyle, od. short, and unusual-

ly obtuse at apex. Inner gonapophysis, g , terminating in an acute spinous point, the outer margin back from the point expanded into a pale flange that is wider towards the base.

Habitat.—Assam (Khasi Hills).

Holotype, male, Cherrapunji, altitude 4,000 feet, August, 1935 (Sircar). *Allototype*, female. *Paralopotypes*, 2 males.

Antocha (Antocha) khasiensis is most nearly related to *A (A.) nigribasis* Alexander (western China), differing most conspicuously in the small size and structure of the male hypopygium. It is readily told from all other previously described species of the Himalayan and Indo-Malayan regions by the extreme basal position of $m-cu$ and the coloration of the body, legs, and wings.

I am greatly indebted to Mr. S. Sircar for the following data on the conditions under which the present series of Tipulids were collected. "The specimens were collected by me personally at light (400 C. P. Petromax). It was showering very mildly and from my experience I can say that this is the best time for collecting Tipulids at light. Hundreds of these flies came to the light, but I could not save all of them as my net got wet and I had to catch them by hand as they rested on a cloth hung up by the side of the light"—S. SIRCAR.

HEXATOMES

PSEUDOLIMNOPHILA COCCUSA sp. n. (Pl. 1 fig. 9; Pl. 2 fig. 14).

General coloration brownish gray; antennae black, wings relatively narrow, almost uniformly tinged with brownish yellow, costal fringe short, its long, subequal to vein R_1 ; R_2 at or close to fork of R_{2+3} , cell M_1 present; cell 1st M long and narrow, subequal to vein M_2 beyond it, $m-cu$ at or close to fork of M .

Male.—Length, about 7 millimeters; wing, 6.8.

Female.—Length, about 8 millimeters, wing, 7.5.

Rostrum dark; palpi black. Antennae brownish black to black throughout, or (male) with the basal half of first flagellar segment paler; flagellar segments subcylindrical to cylindrical, with long conspicuous vericils. Head brownish gray, anterior vertex and orbits clearer gray.

Pronotum dark brownish gray. Mesonotum brownish gray, the praescutum with a slightly darker median stripe, somewhat more intense on cephalic portion, pseudosutural foveae black. Pleura gray, variegated by more blackish gray on ventral anepisternum, sternopleurite, and meron. Halteres pale, the knobs infuscated. Legs with the fore coxae blackened, heavily pruinose, middle and hind coxae much paler, trochanters testaceous

The remainder of legs whitish yellow or in cases the femora more yellowish brown. Wings (Plate 1, fig. 9) relatively narrow as compared to *inconclusa* almost uniformly tinged with brownish yellow stigma very faintly darker to the darker brown. Costal fringe short in both sexes. Venation Sc evening opposite or just before fork of R₅ Sc at its tip R₅ long nearly straight to very gently arcuated at origin R₄₊₅ evening, only a little shorter than vein R₃ R₅ at or very close to fork of R₄₊₅ R₄₊₅ from one and one-half to twice the length of R₅ cell M₁ present about as long as its petiole, cell 1st M₂ relatively long and narrow, its inner end arcuated, the lower face of the cell subsequently or even longer than vein M₁ m-cu at or just beyond fork of M₁ anterior arcuations present.

Abdomen dark brown, sparsely pubescent, the hypopygium a trifle brighter. Male hypopygium (Plate 2, fig. 28) with the outer style, *ad* a little longer than the inner style, *ad* straight to apex decurrent into a slender spine inner margin before apex with a few denticles. Interbasal rods slender each with a low obtuse flange at *near* midlength.

Habitat.—China (Hainan Islands).

Holotype, male, Ta Huan altitude 2000 feet, June 14, 1935 (Gressitt). *Allotype*, female Dwa Bi altitude about 1500 feet, July 21, 1935 (Gressitt).

Pse-dolimnophila concussa is very closely allied to *P. inconclusa* (Alexander) of Japan and China, and may prove to be only a more southern race of the latter. The unusually narrow wings, with narrow cell 1st M₂ serve to separate the fly from the usual, larger and more vigorous *inconclusa*.

PSUDOLIMNOPHILA SETIGESTATA sp. nov. Plate 66, fig. 6.

General coloration of meson tum uniformly dark brown, the pleura a little paler, antennae black throughout, flagellar vein cilia very long, legs brownish black, wings a faint brown tinge costal fringe (male) unusually long and dense, R₅ at or before fork of R₄₊₅, cell M₁ lacking m-cu a short distance beyond fork of M₁, abdominal tergites dark brown, the sternites more brownish yellow.

Male. Length about 5 millimeters, wing, 5.5.

Rostrum obscure yellow to yellowish brown, palpi black. Antennae black throughout, flagellar segments subcylindrical with long verticils that greatly exceed the segments. Head brownish black above, the anterior vertex and orbits a very little paler, anterior vertex relatively wide, exceeding twice the diameter of scape.

Pronotum and mesonotum a most uniform dark brown; the pleura a little paler. Halteres dusky, the base of stem very narrowly paler. Legs with the coxae brown, trochanters yellowish brown, fema. and tibiae brownish black. Wings (Plate 1, fig. 10) with a faint brown shading, stigma oval, slightly darker brown, veins medium brown, much darker than the ground. Costal fringe (male) unusually long and dense, the setae longer than the width of cell Sc_1 . Venation Sc ending shortly before level of fork of R_4 , Sc_2 near its tip, R variable in position, in the paratype being some distance before the fork of R_{4+5} , veins R_{2+3} , R_3 and R_{4+5} in this case being subequal in length; in the holotype R_1 is at or very close to the fork of R_{4+5} , eliminating or greatly reducing the latter element; veins R_2 and R_3 diverging rather conspicuously, cell R_2 at margin being considerably more extensive than cell R_3 ; cell M , lacking, $m-cu$ a short distance beyond fork of M ; anterior arcuatus present.

Abdominal tergites dark brown, the sternites and hypopygium more brownish yellow.

Habitat.—China (Hainan Island).

Holotype, male, Tu Han, altitude 2,500 feet, June 21, 1935 (Grossi). *Paratype*, male Dwa Ri, altitude about 1,500 feet, July 22, 1935 (Grossi).

The long dense costal fringe of the male (though possibly not of the still unknown female) is much like that of the otherwise very distinct *P. costostimbriata* Alexander, of southern India, the latter species having cell M_1 present and very deep. *Pseudolimnophila descripta* Alexander, of the mountains of Formosa, has cell M_1 lacking, but differs from the present fly in other venational details. The female sex of the latter species has the costal fringe short, but the male is still unknown.

Genus HEXATOMA Latreille

Hexatom LATREILLE, Gen. Crust et Ins. 4, 1802: 260.

Subgenus EUHEXATOMA Macfie

Characters as in the subgenus *Eriocera* Macquart, having four branches of radius and four of media reaching the wing margin cell 1st M_2 closed. Supernumerary crossveins in each of cells R_2 , R_3 , and R_4 in approximate alignment (Plate 1, fig. 11).

Type of subgenus—*Hexatom* (*Euhexatom*) *triphragma* sp. nov. (Oriental Region, Eastern China, Hainan Island).

The new subgenus is based on the presence of three strong supernumerary crossveins in the outer radius field of the wing, a character paralleled by other subgeneric groups in the allied

hexatomine genera *Adelphomyia* Bergroth and *Limnophila* Macquart. The present fly is of very strange appearance, the outer radial field giving one a definite impression of resemblance to the wing of a scorpion fly (Mecoptera).

HEXATOMA (HEXATOMA) TIPULACEA n. sp. (Plate 1, fig. 11)

General coloration of thorax brownish yellow, the pronotum with three confluent darker brown stripes, antennal flagellum yellow, femora yellow, the tips narrowly blackened, wings dark brown, the veins narrowly but conspicuously bordered by yellow, wing tip more broadly yellowish, small paired hyaline droplets near outer ends of cells R_1 and R_2 , respectively, supernumerary crossveins in cells R_1 , R_2 , and R_3 , cell M_1 present, one at near two-thirds the length of cell 1st M , abdominal tergites reddish brown, the hypopygium brownish yellow.

Male. Length, about 20 millimeters, wing, 16.

Nostrum dark brown, palpi short, brown. Antennal flagellum 7-segmented, scape and pedicel yellowish brown, flagellum yellow, the outer segments a little darkened, flagellar segments cylindrical gradually decreasing in length outwardly. Head brown, vertical tubercle entire, its margin rounded.

Pronotum brown. Mesonotal prosternum brownish yellow, with three darker brown stripes that are confluent behind, posterior sclerites of notum chiefly brownish black. Pleura obscure yellow, variegated by dark brown on the ventral anepisternum, ventra, sternopleurite, meron, and pleurotergite. Halteres brownish yellow. Legs with the coxae light brown, trochanters more reddish brown, femora yellow, the tips narrowly blackened the amount subequal on all legs and including about the distal sixth or seventh of the segment, tibiae brown, the tips narrowly blackened, tarsi black. Wings (Plate 1, fig. 11) with the ground color dark brown, the veins narrowly but conspicuously bordered by yellow, wing tip more extensively of the same color, two small paired hyaline droplets near outer ends of cells R_1 and R_2 , beyond the supernumerary crossveins of these cells cell 1st A more grayish, cell 2d A yellow, marginated outwardly with gray, vague linear pale streaks in central portions of cells R_1 , M_1 , and M_2 , veins yellow to brownish yellow, contrasting with the dark ground. Scattered macrotrichia on all outer radial branches. Veination Sc, ending about opposite R_2 , R_2+3 a little shorter than the basal section of R_1 , R_1+2 longer than R_2+3 , the supernumerary crossveins in the radial field slightly variable in position, those in cells R_1 and R_2 more oblique

than the one in cell R_5 ; in the left wing of type, the vein in cell R_5 lies more than its own length beyond the one in cell R_4 , whereas in the right wing the elements are nearly interstitial, as illustrated, cell M_1 present, much longer than the distal section of Cu_1 , placed at near two-thirds the length of cell 1st M_1 .

Abdominal tergites deep reddish brown, without differentiated basal coloring on the individual segments; basal and subterginal segments somewhat darker; sternites clearer reddish brown; hypopygium brownish yellow.

Habitat.—China (Hainan Island).

Holotype, male, Liamui, altitude about 1,200 feet, July 31, 1935 (Greaves).

This rather remarkable crane fly requires no comparison with any previously described member of the genus, the subgeneric character of three supernumerary crossveins in the outer radius field being quite unique within the group.

EXATOMA (ERIOTOMA) TUBERCULATA sp. nov. Plate 2, fig. 12.

Belongs to the *perennius* group: general coloration of thorax dull gray, the praescutum with four scarcely differentiated plumbeous-gray stripes that are narrowly bordered by blackish; setae of thoracic dorsum short and inconspicuous; a median series of from three to five small tubercles at cephalic portion of praescutum, halteres and legs black, wings dark brown, with an oval yellow discal area before cord; costal vein in both sexes with abundant short setae; cell M_1 present, abdominal tergites purplish blue, with about the outer third of the segments dull black; hypopygium and shield of otipositor orange.

Male.—Length, about 19 to 24 millimeters, wing 15 to 19.

Female.—Length, about 21 to 25 millimeters, wing, 16 to 17.

Rostrum dark gray; palpi black. Antennae short in both sexes, in male 7-segmented, in female 11-segmented, scape and pedicel black, sparsely pruinose, flagellum obscure yellow to yellowish brown. Head dull black, a little more grayish on front and on posterior orbits, vertical tubercle entire, unusually slender especially in male. Vestiture of head of moderate length.

Pronotum dull dark gray, the lateral angles of the scutum produced into tuberculate lobes; scutellum with a deep median meson on anterior border. Mesonotal praescutum dull gray, with four scarcely differentiated plumbeous gray stripes that are narrowly bordered by blackish, anteromedian portion of praescutum elevated into from three to five small tubercles arranged in a longitudinal row, posterior sclerites of notum dull plumbeous gray. Vestiture of thoracic dorsum unusually short and sparse.

Pleura entirely blackened, very sparsely pruinose. Halteres short, black throughout. Legs entirely black. Wings (Plate 1, fig. 12) dark brown; the anal cells a little paler, an oval yellow discal area before the cord, occupying the outer end of cell R₄₊₅ and adjoining parts of cells R₄ and M₁, with a slight invasion of the extreme base of cell 1st M₁; veins dark reddish brown, brighter in the yellow area, some of the veins adjoining the discal bright tinge very narrowly and insensibly bordered by yellow. Costs with abundant small setae in both sexes, outer branches of R with trichia, more sparse and scattered on R₄, a few scattered trichia on vein M₁ and, in cases, on M₂. Vein 2nd Sc₁ ending shortly beyond R₄, its angulation to spurred very close to origin. R₄₊₅ much longer than R₅₊₆, the latter sub-equal to basal section of R₄, cell M₁ present; m-cu at near two-thirds to three-fourths the length of cell 1st M₁.

Abdominal tergites two to seven velvety, brilliant purplish blue, the caudal margins of the segments dull black, involving about the outer third of the sclerite, sternites more uniformly blackened, the base wings less brilliant blue, male hypopygium and shield of ovipositor orange.

Habitat.—China (Hainan Island).

Holotype, male, Fan Ta, altitude about 1,250 feet, June 3 1935 (Grossiit). A *otype*, female Ta Hien altitude 2,000 feet June 11, 1936 (Grossiit). Paratypes, 2 males with the allotype, June 12 and 13, 1933, 1 male 1 female, Liuan, altitude about 1,200 feet, August 1 and 2 1935 (Grossiit).

By Edwards's key to the Old World species of *Arundina*,¹ the present fly fails to couplet 87, disagreeing with species beyond this point by the lack of yellow or orange areas on the intermediate abdominal segments, as well as in several other features. The fly is quite distinct from all other species known to me.

HERATOMA (TIPULINA) RINTITOMA sp. nov. (fig. 1, fig. 2)

General coloration deep velvety black; head and thorax with long, coarse, erect setae; halteres and legs black, wings strongly blackened, with a narrow white discal area before the cord, numerous macrotrichia on veins beyond cord, co. M₁ looking m-cu beyond outer end of cell 1st M₁ on vein M₂; abdomen velvety black, segments two, four, and five with leaden-colored basal bands, genital shield black, valves of ovipositor orange.

Female.—Length, about 16 millimeters, wing 12.6.

Rostrum black sparsely pubnose, palpi black. Antennae (female) 11-segmented, scape and pedicel black, flagellum brownish black, the measures of the more proximal segments narrowly paler, flagellar segments with long coarse verticils segments gradually decreasing in length outwardly, the terminal a little longer than the penultimate. Head dark gray, with very long, coarse, black setae.

Thorax uniformly velvety black, with long coarse setae especially conspicuous on the dorsum. Halteres and legs black throughout. Wings (Plate 1, fig 13) strongly blackened, the anal cells much paler, grayish, a narrow white discal area before cord, including cells R_1 to Cu , inclusive, the last area narrowly separated from the remainder of the band by a narrow dark seam adjoining vein Cu in cell M , the gray anal cells variegated by more infuscated area at near midlength and by more brightened areas near outer end of cell 1st A and basal portion of cell 2d A , veins dark paler in the discal brightening. Costal fringe short but abundant, longer and more conspicuous basad of h , macrotrichia of veins beyond cord abundant, including all veins from R_1 to Cu , inclusive, more sparse and restricted in the media and cubital fields. Venation slendering nearly opposite R_2 , $R_{1,2}$ much longer than either $R_{3,4,5}$ or $R_{2,3}$, media, veins very faint and difficult to trace, cell M , lacking, m-cu erect, placed beyond the outer end of cell 1st M , on vein M_1 .

Abdomen velvety black, segments two, four, and five with redder-colored or plumbeous basal bands, segments three, six, and seven uniformly blackened, sternites black, genital shield black, valves of ovipositor orange.

Habitat.—China (Hainan Island).

Holotype, female Liang, altitude about 1,200 feet, July 31, 1935 (Gressitt).

Hexatoma (Erocerat) hirtifrons is one of rather numerous species discovered in recent years that runs to *H. (E.) hirta* Walker, by means of existing keys to the subgenus. It is distinguished from allies in this particular group of forms by the coloration of the wings and abdomen, the venation, as the deep fork of cell R_2 and direction and position of m-cu, and by the unusually long erect pubescence of the head and thorax. In the latter feature the species agrees well with *H. (E.) villosa* Edwards (Perak), which has an apical pale crescent on the wings, additional to the pale discal area.

ELEPHANTOMIA (ELEPHANTOMIA) ANGSTISTELLULIA sp. nov. Plate I, fig. 1

General coloration of mesonotum brownish yellow, the pleura a trifle more infuscated, rostrum approximately one-half as long as remainder of body, basitarsus with proximal two-thirds black, the distal third snowy white, wings subhyaline, cell Sc stigma and outer end of cell R_2 uniformly and continuously infuscated, basal section of R_2 almost in longitudinal alignment with Rs , cell $2d$ A very short and narrow, abdominal tergites inconspicuously bicolorous, obscure yellow, the caudal portions of the segments blackened, the outer three segments uniformly blackened.

Male.—Length, excluding rostrum, about 10 millimeters; wing 6.6; rostrum alone, 5.

Rostrum black throughout, approximately one-half as long as remainder of body. Antennae black, flagellar verticils long and conspicuous. Head brown, the orbits narrowly light gray; anterior vertex relatively wide, a little greater than the diameter of scape.

Mesonotum uniformly dull brownish yellow, the pleura a trifle more infuscated. Halteres obscure, the knobs a trifle more dusky. Legs with the coxae weakly infuscated. trochanters brownish yellow, femora brownish black, a little brightened basally, deepening to black at tip; tibiae black, basitarsus black, the distal third snowy white, remainder of tarsi snowy white, the terminal segment infuscated. Wings (Plate I, fig. 11) subhyaline, cell Sc stigma and adjoining narrowed outer portion of cell R_2 uniformly and continuously infuscated, veins black. Veination: Rs strongly arcuated; anterior branch of Rs at origin arcuated in almost the same degree as Rs , its distal portion gently sinuous and running close to R_1 , basal section of vein R_2 almost in longitudinal alignment with the end of Rs , a little shorter than $r-m$, cell 1st M_2 longer than vein M_1 beyond it, $m-cu$ about one-half its length beyond the fork of M , cell Cu gradually widened to margin, vein $2d$ A short, the cell $uqua$, 3 short and narrow.

Abdominal tergites obscure yellow, blackened medially and caudally, the outer three segments uniformly blackened, sternites more uniformly obscure yellow, the caudal portions of the segments more infuscated.

Habitat.—China (Hainan Island).

Holotype. male, Ta Lien, altitude 2,000 feet, June 7, 1930 (Greaves).

Elephantomyia (Elephantomyodes) angusticollula is generally similar to several other species of the subgenus in the Oriental and eastern Palaearctic faunal regions, such as *E. (E.) angusta* (Brunetti), *E. (E.) fuscomarginata* Enderlein, and *E. (E.) uniformis* Alexander, differing from all in the body coloration and the details of venation, especially the very short and narrow cell 2d A. In the last-mentioned regard, the nearest approach to the present fly is found in *uniformis*.

ERIOPTERINI

TRICEROPHTHILIA CHONCOMA RAINANICA sp. nov. Plate 1, fig. 15.

Thorax entirely orange-yellow, immaculate, antennae black throughout, femora obscure yellow basally, passing into brown to blue dark brown; tarsi paling to yellowish brown; wings whitish subhyaline, the prearcular and costal regions clear light yellow, a restricted dark pattern, including the wing tip and a seam along vein Cu₁, R₂ at or beyond the fork of R₂₊₃, abdomen black the bases of the intermediate segments vaguely brightened.

Male.—Length, about 9 millimeters; wing, 7.2.

Female.—Length, about 11 millimeters, wing, 8.5.

Rostrum brown; palpi black. Antennae black throughout flagellar segments cylindrical, the verticils shorter than the segments. Head brownish yellow; anterior vertex reduced to a narrow strip, carinate, the ridge extending caudad onto the posterior vertex.

Pronotum yellow. Mesonotum and pleura entirely deep orange-yellow, immaculate. Halteres with basal third of stem obscure yellow, the outer portion and knob blackened. Legs with the coxae and trochanters yellow; femora obscure yellow basally passing into brown, the tips gradually deepening to dark brown, tibiae dark brown; tarsi paling to yellowish brown, bases of femora with a series of from eight to ten small black spines, posterior tibiae near apex with about four powerful black setae, the outermost shorter. Wings (Plate 1, fig. 15) whitish subhyaline, the prearcular and costal regions clear light yellow at first dark brown; paler brown washes include the extensive wing tip, vague seams along cord, a broad, conspicuous seam in cell M adjoining vein Cu₁, and the axillary region, veins brownish black, luteous in the yellow basal and costal portions. Venation: R₂ at or beyond fork of R₂₊₃; m-cu at or before (base) fork of M; apical fusion of veins Cu₁ and 1st A slight cell 2d A wide.

Abdomen black, the bases of the intermedate tergites very vaguely brightened by brownish yellow, genitalia of both sexes obscure yellow.

Habitat. -China (Hainan Island).

Holotype, male Tu Han, altitude 2,500 feet, June 22, 1935 (Gressitt). A lectotype female, June 23, 1935 (Gressitt).

Treptopeltis (Mongolia, Heilenton is alike to *T. (M.)* *chrysanthemum* Alexander and *T. (M.) flavoculus* Edwards, of Java, especially to the former. The differently patterned thorax, legs, and wings and the uniformly darkened halteres, readily separate the present fly from these somewhat similar species. By my latest key to the Philippine species of *Treptopeltis*² the fly runs to *T. (M.) carbonipes* Alexander, of Mindanao, a very different fly.

MONOTIA (PTILOSTERNAL) RADIOPUNCTATA sp. nov. (Plate 1 fig. 16).

General coloration of mesonotum dark brown, more reddish brown on sides, knobs of halteres darkened, femora yellow, with a narrow but conspicuous brownish black ring just before apex, wings yellow, sparsely patterned with dark brown, stigma oval, extending distad to vein R_2 , vein R_1 gently arcuated, abdominal tergites black, the caudal margin narrowly yellow.

Female.—Length, about 5.6 millimeters, wing, 5.

Rostrum and palpi dark. Antennae with scape brownish yellow, pedicel yellow, flagium broken. Head brownish gray.

Pronotum obscure yellow above, darker on sides. Lateral prosternites light yellow. Mesonotal praescutum dark brown medially, more reddish brown on sides the humeral region with a very restricted area of light yellow, pseudosutural fovea brownish black, scutum dark brown, scutellum testaceous-brown, mediotergite dark, with a pruinose gray triangle on cephalic portion the point directed backward. Pleura reddish brown, the dorsal sclerites somewhat darker. Halteres pale, the knobs darkened. Legs with the coxae testaceous-brown, trochanters testaceous-yellow, femora yellow, with a narrow but conspicuous brownish black ring just before apex, tibiae obscure yellow, the tips narrowly blackened, tarsi orange yellow, darker outwardly. Wings (Plate 1 fig. 16) with the ground color yellow, sparsely patterned with dark brown, the areas including a small circular darkening, origin of R_2 , cord and m-cu, stigma and a

paler brown submarginal wash in outer ends of r_5 and R_4 , no darkening at outer end of vein 2d A, wing tip deeper yellow than the remainder of ground stigma, area oval, extending distad to vein R_4 or virtually so, veins yellow darker in the infuscated areas. Costa, fringe relatively long and conspicuous, numerous macrotrichia on all veins beyond apex of $m-cu$ and on veins M and 1st A nearer the wing base. Venation St_1 ending about opposite one fourth the length of the strongly angulated to weakly spurred Rs , $R_{1,2}$ and R_5 close together at wing margin, vein R_4 gently arcuated, not strongly recurved as in teranishi and a less medial fork about one third longer than its petiole, $m-cu$ less than twice its length before fork of M .

Abdominal tergites black, the caudal margins of the segments narrowly but conspicuously yellow, sternites more brownish yellow, the yellow apices not so clearly defined.

Habitat (China, Hainan Island)

Holotype, female Ta Han altitude 2,500 feet, June 21, 1935 (Gressitt).

The nearest described allies are *Gonomyia* (*Ptilostena*, *longipennis* Alexander (Lochchoo Island Is.) and *G. (P.) teranishi* Alexander (Japan, eastern and southern China), which differ in the coloration of the body, the uniformly pale femora, and the details of wing pattern, and venation notably the more strongly arcuated vein R_4 .

GONYIA TROPICALES CONQUISTI sp. nov. Plate 4, fig. 11.

Belongs to the *subfasciella* group, allied to *rubrovittata*, general coloration of notum dark gray, scutellum obscure yellow, darkened medially at base, femora yellow, with a narrow, dark brown subterminal band, the yellow apex subequal in extent or slightly wider, wings tinged with grayish, the costa, border and apex whitened, abdominal tergites black, the caudal borders of the segments narrowly yellow.

Female.—Length, about 5 millimeters, wing, 4.

Rostrum and palp. black. Antennae with scape and pedicel yellow above, darker on lower surface, flagellum broken. Head above obscure yellow, the central portion of posterior vertex more infuscated, its sides and the genae again darkened.

Pronotum yellow, darker on sides, pretergites light yellow. Mesonota, praescutum and scutellum dark gray, pseudosutura, fore dark red, inconspicuous against the ground, scutellum obscure yellow, the basal portion darkened medially, postnotum gray. Pleura brownish black with a conspicuous whitish longitudinal stripe extending from the fore coxae to the base of

abdomen, ventral sternopleurite and meron darkened, pteropleurite and pleurotergite somewhat paler brown than the anterior or sclerites. Halteres yellow, the knobs weakly darkened basally. Legs with the fore coxae whitened, middle and posterior coxae darker basally, the tips pale; femora yellow, with a narrow, dark brown, subterminal ring, this subequal to or narrower than the yellow apex; tibiae yellow, tarsi broken. Wings (Plate 1, fig. 17) with a grayish tinge, the costal border and apex whitened, the latter including the distal ends of cells R_4 , R_5 and 2d M as far basad as the level of the tip of vein R_4 , stigma small, oval, brown, interrupting the white costal border, restricted darker areas at areculus, origin of Rs , along cord and outer end of cell 1st M_2 , and as a seam on vein R_2 ; veins pale darker in the infuscated areas, more whitened in the pale portions of the wing. Costal fringe pale, relatively long and conspicuous, rather numerous macrotrichia on veins R_{4+5} , M_1 , distal section of R_5 , and distal sections of M_{1+2} and M_2 ; a few trichia at extreme outer end of vein 2d A . Venation: Sc_1 ending opposite origin of the long Rs , Sc_2 close to its tip; Rs subequal in length to stem of cell R_3 ; vein R_1 very short, perpendicular to R_2 at margin considerably more extensive than cell R_3 , vein R_4 rather strongly upcurved at margin; $m-cu$ shortly before fork of M .

Abdominal tergites black, the caudal borders of the segments narrowly yellow; sternites somewhat more grayish black, the pale borders narrower. Cerci horn-colored, darkened basally.

Habitat.—China (Hainan Island).

Holotype, female, Ta Han, altitude 2,500 feet, June 21, 1937 (Gressitt).

Gonomysa (Lipophleps) conquisita is readily told from other members of the group that are closely allied to *maculicollis* (de Meijere), including *pallidostigmata* Alexander, by the narrow brown femoral rings. In all species of the group hitherto described, these annuli are black, very broad, and preceded and followed by narrow whitened rings.

GONOMYS (LIPOPHLEPS) PALLICOSTATA n. sp. Plate 1, fig. 18; Plate 2, fig. 22.

Allied to *bicolorata*; femora brown, the extreme tip abruptly pale, wings suffused with brown, the costal and apical portions narrowly white, the remainder of membrane more or less variegated by paler areas; stigma oval, dark brown; Sc short, Sc_1 ending before origin of Rs a distance nearly equal to the length of the latter vein, male hypopygium with two dististyles, the outer one bilobed, its outer arm a long, slender, simple rod, the

inner arm a densely hairy cushion, inner style terminating in a curved spine and bearing a second very long spine on outer margin at near midlength.

Male. Length, about 3.2 to 3.4 millimeters, wing, 16 to 18.

Female. Length, about 4 millimeters, wing, 4.

Rostrum and nauplii black. Antennae with the scape and pedicel yellow, flagellar black, flagellar segments (male) with unusually elongate vertebrae. Head chiefly yellow, badly flexed in types, but apparently with central darkening on posterior vertex.

Pronotum and lateral pretergites pale yellow, the former darkened on sides. Mesonotal prescutum and scutum almost uniformly dark brown, the pseudosutural foveae black, scutellum black basally, obscure brownish yellow or brown behind, mediotergite blackened, the anterolateral portions obscure yellow. Pleura chiefly dark brown, somewhat paler dorsally on the pteropleurite and pterotergite and ventrally on the ventral sternopleurite, a broad white longitudinal stripe extends from the fore coxae across the dorsal sternopleurite, ventral pteropleurite and meral area to base of abdomen. Halteres yellow, the lower face of knob dusky. Legs with the coxae pale, their basal portions dark brown, the fore coxae more uniformly whitened, trochanters testaceous-yellow, femora brown, somewhat darker outwardly, the extreme tip abruptly pale, tibiae and tarsi brown. Wings (Plate 1, fig. 18) almost uniformly suffused with brown, the costa, border and apex conspicuously cream white, the degree nearly uniform throughout the area except before the stigma where the pale crosses R_5 into cell R_5 , stigma oval, dark brown, dusky ground color slightly variegated by paler areas, as in many allied forms, veins brownish yellow, paler, almost white, in the anterior pale portion. Costal fringe sparse but long and conspicuous. Venation: Sc short, Sc ending far before origin of R_5 , the distance on costa nearly as long as R_5 ; none branches of R_5 divergent, co_1 , R_5 narrowed at margin, $m-cu$ a short distance before fork of M .

Abdominal tergites dark brown, the posterolateral angles yellow, more broadly and conspicuously so on outer segments subterminal segment more uniformly darkened, hypopygium yellowish brown. Male hypopygium (Plate 2, fig. 29), with two terminal dististyle ex, outer style, ad , knobbed, the outer arm a simple, slender, blackened rod, a little longer than the bas style, inner lobe more than one-half as long as the outer, fleshy, the distal half with abundant yellow setae. Inner dististyle, ad ,

small, terminating in a slender, curved, acute spine; on outer margin at near midlength produced into a second, very long, nearly straight spine that exceeds the style in length, its base dilated. Phallosome, *p*, with two divergent subapical lobes, the tips with microscopic setae.

Habitat.—China (Hainan Island).

Holotype, male, Ta Hien, altitude 2,500 feet, June 23, 1935 (Gressitt). Autotype, female, Ta Hien, altitude 2,000 feet, June 19, 1935 (Gressitt). Paratype, male, Liamui, altitude about 1,200 feet, August 3, 1935 (Gressitt).

The nearest described ally is *Gonomyla (Lipopkleps) bicolorata* Alexander (Luzon, Hancan), which is similar in general appearance but the structure of the male hypopygium is very different.

GONOMYIA (LIPOPKLEPS) PRUVIRENSIS sp. nov. Plate 1, fig. 19; Plate 2, fig. 20.

Mesonotum brownish black, sparsely pruinose, scutellum yellow, darkened medially at base, thoracic pleura with a longitudinal yellow stripe, femora infuscated with a broad, blackish, subterminal ring, preceded and followed by narrow, clearer yellow annuli, tibiae and tarsi black, wings grayish subhyaline, the costal border whitened, the disk with extensive brown clouds; Sc short male hypopygium with the outer dististyle a long blackened rod, its distal fifth expanded and densely set with a cushion of spines.

Male.—Length about 3.5 millimeters, wing, 3.6 to 3.7.

Rostrum obscure brownish yellow, palpi black. Antennae black, the scape more or less brightened. Head orange-yellow, variegated by brownish black on central portion of disk.

Mesonotum brownish black, sparsely pruinose; pseudosutural fovea black, scutellum yellow, darkened medially at base, postnotum more heavily pruinose. Pleura brownish black, the dorsal pteropleurite and pleurotergite more infuscated; a relatively narrow but conspicuous, pale yellow, longitudinal stripe extending from the fore coxae to the base of abdomen, passing beneath the root of halteres, this stripe narrowly bordered dorsally by a dark stripe. Halteres yellow, most of the knobs infuscated. Legs with the coxae darkened basally, paler at tips, trochanters brownish testaceous; femora infuscated, the distal third more yellowish, inclosing a broad, more-blackened subterminal ring, the anterior tip and postmedian pale annulus much narrower, posterior femora with long erect setae; tibiae and tarsi brownish black. Wings (Plate 1, fig. 19) with the ground color grayish subhyaline, variegated by more brownish clouds near wing base,

across outer ends of cells R_2 to 1st A inclusive, and beyond the cord, costal border and conspicuous areas before and beyond stigma white, stigma oval, pale brown, veins pale brown, still paler in the brightened costal portions darker along cord. Costal fringe relatively long and conspicuous, trichia of veins beyond cord relatively abundant. Venation Sc short, Sc_1 ending some distance before origin of Rs , the distance on C being about two-thirds the length of Rs alone, r_m long, gently arcuated.

Abdomen blackened, the caudal borders of both tergites and sternites restrictedly paler, hypopygium large, more chestnut brown, the conspicuous outer dististyle black. Male hypopygium (Plate 2, fig. 30) with the two dististyles terminal in position. Outer dististyle $ad.$, a long, nearly straight, blackened rod that is considerably longer than the basistyle, on apical fifth a little dilated and bearing a dense brush or cushion of spines, outer surface of stem of style with abundant spinous points or teeth. Inner dististyle, $ad.$ small, simple, long, and slender. Phanosome, p , not clearly evident in material studied, consisting of flattened pale cushions and a single, acute, smooth black spine.

Habitat—Assam (Khasi Hills).

Holotype male, Cherrapunji, altitude 4,000 feet, August, 1935, at night (Sircar). Paratotype, 2 males.

By Edwards's key to the Oriental species of *Lipophlebus*,⁴ the present fly runs to *subnebulosa* Edwards, a quite different species with the wing pattern distinct. As usual in the genus, the male hypopygium offers the chief feature for the separation of the species from allied forms.

COMONIA (LIPOPHLEBUS) SIMCARI sp. nov. Plate I fig. 28 Plate II fig. 11

General coloration dark brownish gray, scutellum obscure yellow on posterior border, pleura with a light yellow longitudinal stripe, legs dark brown, posterior femora with a series of more than a score of erect setae, wings with a faint brown tinge, the disk slightly variegated by more grayish subhyaline areas, Sc short, male hypopygium with the outer dististyle a simple rod, inner dististyle bearing two long, slender pale arms, each tipped with a small blackened spine phanosome with appressed spinous points.

Male—Length about 3 millimeters, wing 3.3

Rostrum and palpi black. Antennae black throughout. Head above orange-yellow, the central portion of vertex more darkened.

Pronotum and anterior sternite protergites yellow. Mesonotal proscutum and scutum uniformly dark brownish gray, without markings, scutellum obscure yellow on the posterolateral border, broadly darkened medially at base, postnotum yellow on cephalic half, the posterior part on darkened. Platea with the discoperitral membrane and most of proscutellum and postnotum obscure yellow, the more ventral platea brownish gray with a conspicuous light yellow longitudinal stripe extending from and including the fore coxae, reaching the base of abdomen. Halteres dark, with most of the lacinia light yellow. Legs with the fore coxae yellow, the remaining coxae and all trochanters more trochanter, remainder of legs dark brownish gray, femora with an evenly spaced series of more than a dozen of long streaks additional to the usual appressed vestiture. Wings (Plate 1, fig. 2) with a faint bare neck line, the pterostigma and costa portions more strongly yellow, stigma almost over, a trifle darker than the ground color, it is segregated by more grayish pubescence areas in the posterior half of wing, the radial field more uniformly pale in the veins pale below, a little lighter in the costal and pterostigma feathers. Frons fringed moderately long, at base with some very sparse and tiny anterior branch of fr. without thick R_1 and a. outer branch of M_1 with numerous trichia. Variation. Subjet, R_1 , ending some distance before or just of M_1 , the distance on C equal to about two-thirds the length of R_1 , R_1 only a little shorter than its anterior branch, the latter directed strongly outwards, no cell R_1 at margin to be very wide apically close to fork of M .

Abdomen longish dark brown, the scutellum particularly pale, sternites and hypopygium more yellowish. Male hypopygium (Plate 2, fig. 3), with two d. st. stria, both terminal in position. Outer side of a simple submarginal lobe with a small median flange, the central third of the lobe a little wider, the apex obtuse. Inner side of bearing two, long, slender, pale arms each tipped with a row of trichia, the outer and a little longer than the inner, the latter bearing two spines on one side and only one on the other, but the spines not appreciably elongated, and the spines on may be normally unspined. Proboscis μ appearing as two divergent flattened black horns that run out into smooth black spines, the so far microscopically unspined and provided with appressed spinulous points.

Habitat. Assam, Khasi Hills.

Holotype male. Cherrapunji, altitude 4,000 feet, August, 1936, at light (Sircar).

I take great pleasure in naming this distinct crane fly in honor of the collector of this interesting series of *Tipulidae* from the Khasi Hills, Mr. S. Sireat. The species is readily distinguished from other, generally similar, allied species in the faunal area, such as *flavomarginata* Brunetti and *assamiana* sp. nov. in the structure of the male hypopygium.

CONOMIA (LIPONIUS) ASSAMANA sp. nov. Plate 1 fig. 21. Plate 2 fig. 22.

General coloration dark brown, scutellum obscure yellow, darkened medially at base; pleura with a clear yellow longitudinal stripe; knobs of the halteres darkened, legs brownish black, wings with a faint brown tinge, the costal border whitened, stigma and narrow seams along cord and outer end of cell 1st M. vaguely seamed with pale brown. Sc short, abdominal tergites uniformly dark brown, the sternites and hypopygium yellow, male hypopygium with both dististyles terminal in position, the inner at apex produced into a long yellow arm that is tipped with a small black spine and bears a single very long bristle that is longer than the arm itself.

Male.—Length, about 2.7 millimeters; wing, 3.

Rostrum and palpi black. Antennae with the scape black, pedicel chiefly orange, flagellum black. Head light yellow, the central portion of vertex weakly darkened.

Pronotum and the lateral pretergites light yellow. Mesonotal praescutum and scutum dark brown, the surface sparsely pubescent, pseudoscutular fovea reddish brown, scutellum obscure yellow, the base darkened; mediotergite extensively obscure yellow, darkened behind and on sides. Pleura with dorsal sternites and membrane brownish yellow; a broad, clear yellow, longitudinal stripe extending from the fore coxae to the base of abdomen, passing beneath the halteres, narrowly bordered above by darker brown; ventral sternopleurite darkened. Halteres with the stem dusky, the knob yellow. Legs with the coxae testaceous, the fore pair somewhat clearer, remainder of legs brownish black; posterior femora with moderately erect setae along the entire length. Wings (Plate 1 fig. 21) with a faint brown tinge, the prearcular and costal portions more whitened stigma long-oval, slightly darker brown than the ground, cord and outer end of cell 1st M. vaguely seamed with pale brown, best indicated by a darkening of the veins, veins brown, more yellowish in the whitened areas. Anterior branch of R_s without trichia; R_s and all outer branches of M with numerous trichia. Venation: Sc short, Sc_1 ending some distance before origin of Rs , the distance on C about one-half Rs , anterior

branch of Rs directed rather strongly cephalad so cell R_5 at margin is only a little more than one-third as extensive as cell R_4 , meeting at fork of M .

A dorsal tergites are forming dark brown sternites and hypopygium yellow. Male hypopygium (Plate 2, fig. 12) with the two dististyles terminal in position, the outer style, od , a glaucous darkened blade shaped more or less like a cleaver the margins smooth. Inner dististyle in at apex extended into a long, slender yellow arm that is tipped with a small black spine and a single very long seta that is longer than the arm itself, the arm at near mid length bears a dense group of short setae. Phallosome, p , consisting of curved yellow rods that terminate in a dense brush of setae.

Habitat Assam (Khasi Hills).

Holotype male, Cherrapunji, altitude 1,000 feet, August 1935 at light (Sircar).

I take much pleasure in naming this distinct species in honor of Mr. Nissor Singh, veteran collector of the Srimaayan Butter Fly Company, who celebrated his eightieth birthday in December 1935. The fly is allied to species such as *Gonomyia* (*L. populea*) *scremi* sp. nov., and *G. (L.) lateimarginalis* Alexander differing very conspicuously from all described forms in the structure of the male hypopygium.

CRYPTOLADIS BENOITI BILALI RA sp. nov. Plate 1 fig. 22 Plate 2 fig. 23.

General coloration dark gray, the scutellum yellow, darker medially at base, legs with short setae, wings with a slight grayish tinge, the stigma, reg. o., weakly suffused, prearcular and costa, regions more whitened, cell 2a A wide vein 2d A deflected cauda on its distal third, male hypopygium with the dististyles subterminal in position, profoundly bifid, the inner arm longer than the outer.

Male.—Length about 3.5 millimeters, wing 3.8.

Female.—Length about 3.6 millimeters, wing 4.

Rostrum dark, palps unisected. Antennae dark throughout, pedicel black, outer flagellar segments elongate. Head uniformly gray.

Pronotum yellowish white. Mesonotal praescutum and scutum almost uniformly dark gray or blackish with a relatively sparse pubescence, scutellum yellow, darker medially at base, post notum gray. Pleura dark brownish gray, the dorsopleural region yellow. Halteres pale, the knobs darkened. Legs with the coxae and trochanters testaceous brown, femora obscure yellow, the tips of unisected tibiae and tarsi brownish black, vestiture of legs

short and appressed, inconspicuous. Wings (Plate 1, fig. 22) with a slight grayish tinge, the stigma region weakly suffused, a vague darkened seam along cord, best indicated by a more intense coloring of the veins traversing, prearcular and costal regions more whitened, veins brown, pale in the whitened areas. Costal fringe relatively long and conspicuous. Venation R_2 a little shorter than R_{2+3} , meeting at near mid-length of M_{2+3} , cell 2d A wide the vein deflected caudad on its distal third.

Abdomen dark brown, the hypopygium brightened. Male hypopygium (Plate 2, fig. 33) with the ninth tergite 9t having each outer lateral angle produced into a slender straight point median area of tergite slightly produced, the caudal border gently concave. Dististyle 4, subterminal, in position, long and slender, profoundly lobed, the outer arm only about one-half as long as the inner but somewhat stouter. Edeagus 6, terminating in a very long needle-like point.

Habitat.—China (Hainan Island).

Holotype, male. Ta Hien, altitude 2,000 feet June 1, 1935 (Gressitt). A holotype, female. Paratotype, 1 female.

Compared with other similar regional species of *Breoura* that have the wings broad, cell 2d A wide, inconspicuous yellow legs, and conspicuously brightened scutellum, the present fly is readily told by the somewhat remarkable male hypopygium, especially the dististyle.

CRYPTOLABIS (BREOURA) SETOSIPES sp. nov. Plate 1, fig. 23. Plate 2, fig. 34.

Belongs to the *trichopoda* group, general coloration black scutellum obscure yellow, wings with a dusky tinge, the costal border more whitened, a broad dark seam along cord, cell 2d A narrow, male hypopygium with the lateral angles of the tergite extended caudad into narrow arms, dististyle deeply lobed, the inner arm slender.

Male.—Length, about 3.3 millimeters. wing, 4.

Female.—Length about 3.5 millimeters, wing, 4.

Rostrum testaceous, palp. brown. Antennæ apparently 14-segmented, short, dark brown, flagellar segments passing through short cylindrical into long-cylindrical, terminal segment longer than the penultimate, constricted at near mid-length, verticils very long and conspicuous. Head light gray, setae and punctures conspicuous.

Prorottum testaceous-gray. Mesonotal praescutum dull black, the humeral region scarcely brightened, scutellum including median area, dull black, scutellum obscure yellow darker medially at base, parascutella black, mediotergite dark, heavily gray

pruinoses. Pleura black, heavily pruinose, dorsopleural membrane paler. Halteres dusky, the base of stem restrictedly brightened the knobs a little paler. Legs with the fore coxa black, the middle and hind coxa a little paler; tenebanters tarsaceous-yellow, femora brown, tibiae and tarsi brownish black, segments with very long erect setae as in the group, claws (male) very long and slender each with a long, pale erect seta or setoid spine at base. Wings (Plate 1, fig. 22) with a dusky tinge, the entire costa, border both before and beyond the stigma whitened, stigma and a broad confluent seam along the cost darker than the ground, basal portions of wing a trifle infuscate, darker, paler in the whitened costa, post. margin. Venation Sc ending on postic cord, Sc not far from its tip, cell 2d A narrow.

Abdomen, including hypopygium, brownish black. Male hypopygium (Plate 2, fig. 24) with the tergite 9 produced laterad and caudad into slender glaucous points, median point of caudal border likewise produced into a low triangular point. What seems to be a part of the eighth sternite is represented by a slender pale structure that terminates in two strong modified setae, suggesting the condition found in *Stylogomphus*. Dististyle d, terminal deeply bifid, the broader outer arm with numerous setiferous punctures, including a dense group at apex, before tip, near inner margin of lobe, with two slender spines, inner arm nearly as long but much slenderer, with setae only at apex. Aedeagus n, broadly depressed except on apical portion.

Habitat.—China (Hainan Island).

Molotype, male, Ta Li an, altitude 2,000 feet, June 11, 1936 (Greaves); *Allotype* female, Li Yuan, altitude about 1,200 feet, July 31, 1936 (Greaves); *Paratotype*, femora

In its hypopygial structure *Cryptolabis* (*Brevirostris*) *reticulata* is very different from the other members of the trichopoda group described to this date.

Cryptolabis reticulata consists of one male, fig. 24.

Belongs to the trichopoda group closely allied to *setiferus*, male hypopygium with the outer lateral angles of tergite produced caudad into very long slender blades, the tips subacute, dististyle simple, appearing as an elongate blade, narrowed outwardly to the obtuse tip on outer face at near two-thirds the length with a small peglike spine.

Male.—Length, about 3.3 millimeters; wing, 4.

Female.—Length, about 3.5 millimeters; wing, 4.

Rostrum and *palpi* dark. Antennae of moderate length, dark throughout, apparently 15-segmented, basal flagellar segments

short ova, the outer segments more elongate with very long conspicuous erect setae. Head gray.

Mesonotum dark black, the surface very sparsely pubnose; scutellum obscure brownish gray the base darkened medially; postnotum more heavily pubnose. Halteres weakly suffused with dusky, especially the central portion of stem. Legs with the coxae brownish testaceous, trochanters obscure yellow, femora brown, tibiae obscure yellow, the tip narrowly darkened especially the distal portions of posterior legs; tarsi brown passing into black outwards, segments of legs with very long conspicuous setae as in the group. Wings with a strong dusky tinge, the costa region more whitish, a darkened cloud along cord, base of cell r_5 slightly infumated, leaving rather clearer areas before and beyond the cord, stigma a little darker, veins dark, somewhat paler in the costa field. Venation virtually identical with that of *setosipes* cell 2d A a trifle narrower.

Abdomen, including hypopygium brownish black. Male hypopygium (Plate 2, fig. 3a) with the outer lateral angles of tergite 9th produced caudad into very long slender blades the tips subacute caudal margin between the horns transverse or very slightly protuberant, not produced into a point as in *setosipes*. Dististyle, simple appearing as an elongate blade that narrows outward, the tip acute, outer face of style at near two-thirds the length with a small peg-like spine before apex of style near inner margin with two or three small spinous points as in *setosipes*.

Hab. of — China (Hainan Island).

Holotype male, Davao B. alt., inc. about 1,500 feet. July 21, 1935 (Gressitt). Autotype female.

Cryptolabis (Biswaria) cunsona is very similar in its general appearance to *C. (B.) setosipes* sp. nov., but is entirely distinct in the structure of the male hypopygium.

STRIGONOMYIA HOLOMELANIA sp. nov. Plate 1, fig. 2a; Plate 2, fig. 2a.

Entire body black. Halteres and legs black, the tarsal segments slightly paler on basal portions, wings narrow whitish subhyaline, the cord and vein C_2 veined with brown, anterior branch of Rs oblique, male hypopygium with the basistyle bearing two spines, the inner one only half the length of the outer, outer lobe of dististyle with a dense group of spines near base, tenth tergite with median lobe very slender, ninth sternite broaded at apex.

Male — Length about 5 mm. (meters, wing, 3.4

Rostrum and palpi black. Antennae black, the outer flagellar segments a trifle paler. Head black.

Thorax entirely black including the coarse but unmodified setae. Halteres black. Legs black, the basal three tarsa, segments 2 very little paler on their proximal portions. Wings (Plate 1 fig. 24) narrow, whitish subhyaline, the cord and vein Cu stained with brown, veins brown. No macrotrichia on veins behind R₁, excepting a complete series of about twenty-two on vein R₂ and an isolated bristle on anterior branch of R₃ two or three trichia on outer ends of distal sections of medial veins. Venation. Anterior branch of R₂ oblique, cell 1₁, M₁ long and narrow, exceeding any of the veins beyond it, m-cu minute, 1/3 near one third the length of cell 1₁ M₁, vein 2d A unpaired but strongly curved near outer end.

Abdomen black throughout. Male hypopygium (Plate 2 fig. 16) with the basistyle, b, bearing two unequal spines on a short apical lobe, the outer spine about twice the length of the inner, flattened on basal half, inner spine obtuse at apex. Tip of basistyle with an acute blackened spine that is directed mesad. Outer lobe, c, of distinctly relatively stout bearing a dense group of comb of equal black spines on mesal face near base. Inner lobe, d, produced into two arms. Tenth tergite, f, with the median lobe very slender appearing as a 1-gulata structure ciliated with abundant erect setae. Ninth sternite, g, lobed at apex, each lobe obtusely rounded, the median notch acute, the two usual modified setae placed basally on lobes, unusually slender and more or less decussate.

Habitat.—Assam (Khasi Hills).

Holotype, male, Cherrapunji, altitude 4,000 feet, August, 1935, at light (Stearns).

Styringomyia hololeptica is very different from all described species that have bispinous basistyles on the male hypopygium. The uniformly black coloration of the body, halteres, femora, and tibiae provide characters that separate the fly from all species of the genus hitherto described. It seems to be most nearly allied to *S. obscure Brunneti*, yet is amply distinct in the coloration of the body, wings, and legs.

ILLUSTRATIONS

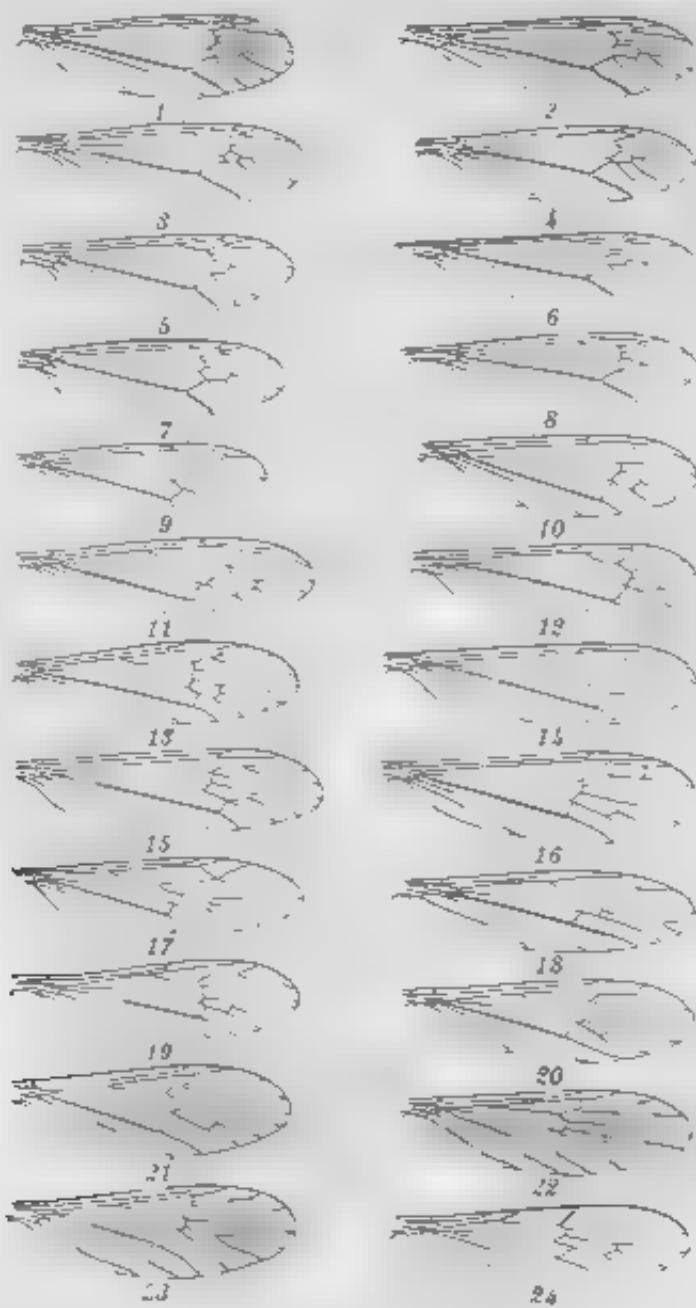
1a. *Abdomen*. 2. *Anal style* of *distictis* of dorsal discellule. 3. *inner distictis* of outer discellule. 4. *phallosome* of *sternalis* of *longula* of ventral discellule.

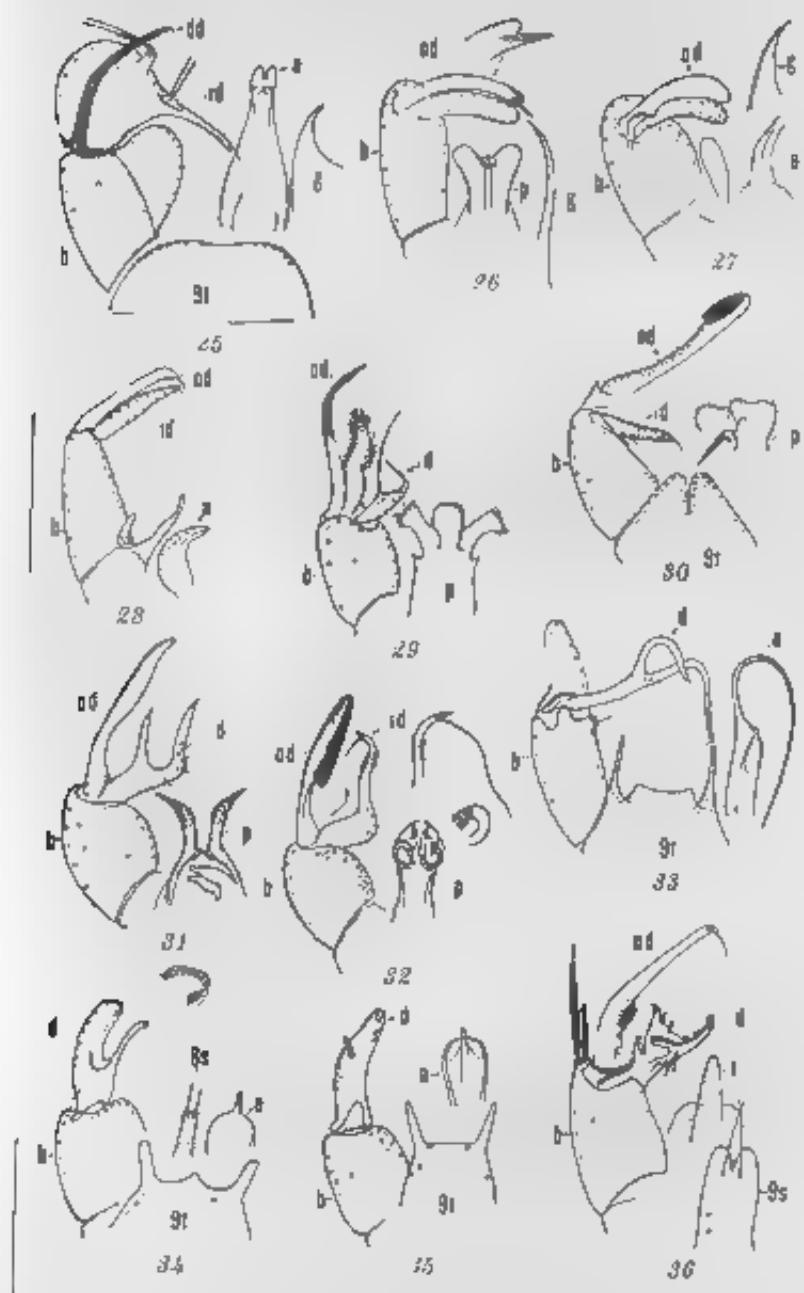
PLATE 1

FIG. 1. *Lenguria kalinowskii* sp. nov., venation.
 2. *Nepaloceraea kalinowskii* sp. nov., venation.
 3. *Phalaecocera tenuipes* sp. nov., venation.
 4. *Limonia (Grenatlimonia) geniculata* sp. nov., venation.
 5. *Limonia (Limonia) caecicornis* sp. nov., venation.
 6. *Limonia (Lithonea) quinquecostata* sp. nov., venation.
 7. *Antocha (Antochae) flavidula* sp. nov., venation.
 8. *Antocha (Antochae) khasiana* sp. nov., venation.
 9. *Pseudolimnophila canescens* sp. nov., venation.
 10. *Pseudolimnophila reticulata* sp. nov., venation.
 11. *Hesalema (Echecatama) leiphragma* sp. nov., venation.
 12. *Hesalema (Priscera) tuberculata* sp. nov., venation.
 13. *Hesalema (Eriocera) kirkiihans* sp. nov., venation.
 14. *Elephantomyia (Elephantomyioides) iniquitatem* sp. nov., venation.
 15. *Treptocerha (Mongoma) kalinowskii* sp. nov., venation.
 16. *Genomyia (Pilostena) kalinowskii* sp. nov., venation.
 17. *Genomyia (Lipophlepe) conquistata* sp. nov., venation.
 18. *Genomyia (Lipophlepe) palauensis* sp. nov., venation.
 19. *Genomyia (Lipophlepe) pulvinifera* sp. nov., venation.
 20. *Genomyia (Lipophlepe) strobli* sp. nov., venation.
 21. *Genomyia (Lipophlepe) missouriensis* sp. nov., venation.
 22. *Cryptolebia (Bracon) deladoux* sp. nov., venation.
 23. *Cryptolebia (Bracon) reticulata* sp. nov., venation.
 24. *Styringomyia kalinowskii* sp. nov., venation.

PLATE 2

FIG. 25. *Limonia (Lecanostoma) kalinowskii* sp. nov. male hypopygium.
 26. *Antocha (Antochae) flavidula* sp. nov. male hypopygium.
 27. *Antocha (Antochae) khasiana* sp. nov. male hypopygium.
 28. *Pseudolimnophila canescens* sp. nov. male hypopygium.
 29. *Genomyia (Lipophlepe) palauensis* sp. nov., male hypopygium.
 30. *Genomyia (Lipophlepe) pulvinifera* sp. nov., male hypopygium.
 31. *Genomyia (Lipophlepe) strobli* sp. nov. male hypopygium.
 32. *Genomyia (Lipophlepe) missouriensis* sp. nov. male hypopygium.
 33. *Cryptolebia (Bracon) deladoux* sp. nov. male hypopygium.
 34. *Cryptolebia (Bracon) reticulata* sp. nov., male hypopygium.
 35. *Cryptolebia (Bracon) canescens* sp. nov., male hypopygium.
 36. *Styringomyia kalinowskii* sp. nov., male hypopygium.





BOOKS

Acknowledgment of all books received by the Philippine Journal of Science will be made in this column, from which a selection will be made for review.

RECEIVED

JULY 1, 1936

BONKHE, ABRAHAM and F. JACOBSON. Sex habits, a r. a factor in well-being. Tr from the German by Eden and Oscar Paul. N. Y. Emerson Books, 1933. x + 190 pp. 12s. Price \$2.50.

BUKES, H. W. The physiology of domestic animals. 10 rev. & enlarged. N. Y. Constable & Co., 1935. xvi + 643 pp. 12s., tables, figures. Price, \$6.

HARROWER, J. R. Three lectures in cancer surgery in everyday practice. Glendale, California. The Harrower laboratory [c. 1936]. 62 pp. Price \$1.

HARVEY, W. M. CHANCE, and HARRY HILL. Milk production and control by Wm. Clancy Harvey and Harry L. E. London. H. K. Lewis & Co., 1936. 566 pp. 12s. Price \$10.50.

HODSON, Mrs. CORA B. S. Human sterilization to-day: a survey of the present position. London. Watts & Co., 1934. vi + 56 pp. Price, \$0.25.

International institute of agriculture. Rome. The world agricultural situation in 1933-34 (World agricultural conditions and trends, markets and prices. Agricultural policies and conditions in the different countries). Economic commentary on the International year book of agricultural statistics for 1933-34. Rome, 1936. vi + 502 pp., tables. Price, \$2.50.

JEFFREYS, LAIRD. Earthquakes and mountains. London. Methuen & Co., 1935. x + 183 pp. front plates, diagrs. Price, \$2.

JOHN, H. J. Diabetes manual for patients. 2d ed. St. Louis, Missouri. The C. V. Mosby Co., 1934. 232 pp., front. Ius. tables, diagrs. Price, \$2.

LORD, F. T. Lobar pneumonia and serum therapy, with special reference to the Massachusetts pneumonia study [by] Frederick T. Lord and Roderick Jeffress. N. Y., The Commonwealth Fund, 1936. 9 pp. 12s., plate diagrs. Price, \$1.

RITSCHER, W. H. Criteria of capacity for independence. Jerusalem. Syrian Orphanage press, 1934. x + 152 pp. Price, \$2.

REVIEWS

The Bacteriological grading of Milk. By G. S. Wilson. Medical Research Council, Spec. I Report Series, No. 206. His Majesty's Stationery Office, London, 1935. 392 pp. Price, \$2.

This book gives the results of the author's critical studies of the various technical procedures that have been heretofore used

in the examination of milk. The usefulness of these procedures is discussed extensively with recommendations on the methods that should be followed.

A description of the modified methylene blue reduction test is given, and, according to the author, the test seems to fulfil most of the requirements demanded of the routine grading of raw milk. It gives more information about the milk than does the plate count, the performance of which requires an elaborate procedure by highly skilled workers. According to him the plate count seems to afford no better index of the sanitary conditions of production or of the keeping quality of the milk than the Breed test or the modified methylene blue test. The latter test could be advantageously applied even to certified milk.

Whether the test is suitable for the examination of freshly pasteurized milk or not is doubtful, but there is reason to believe that it could well replace the plate count on bottle samples delivered to the consumer.

Finally it is recommended that whatever test is used no attempt should be made to divide milk into more than three or four classes. From the public health point of view probably only two divisions need be made on the basis of cleanliness, namely, (a) milk that is suitable and (b) milk that is not suitable for human consumption in the liquid state. T. R. R.

The World Economic Survey, 1934-35. Fourth Year. Economic Intelligence Service League of Nations, Geneva, Switzerland, 1935. 310 pp. Price \$2.

The book is an extensive review of the world economic and financial developments up to July 1935 being the fourth of an annual series published by the League of Nations. The significant events featured in the international economic commotion during the last few years being presented in a comprehensive and coherent manner, this survey surely is indispensable to anyone who desires to gain a full grasp of the world economic situation. Considerable emphasis is laid on the subjects of currency, production, overseas trade, employment, and industrial recovery. Statistical tables, indices and graphs are widely distributed from cover to cover, with the corresponding explanations so given as to be intelligible to the lay reader.

The opening chapter presents a kaleidoscopic view of the chaotic state of economic affairs the world over in 1934. Various steps undergone by the government towards the solution of the problems of finance and trade are mentioned as each country is surveyed. The movement of agricultural and industrial

prices is graphically dramatized by charts and tables. Statistical data of different countries illustrate impressively the law of supply and demand as it affects production, prices, and consumption. With the dawn of industrial recovery is treated the question of unemployment and stability of wages. The rôle played by the National Recovery Act, of all movements, is mentioned in this connection. The recent adjustments in international trade and equilibrium and the expanding basis of credit are equally dealt with comprehensively. The last chapter reviews the more recent constantly changing scenes in the world economic "movies," prominent among them being the "New Deal" program which has become linked with the Roosevelt administration.

The work is well indexed, and on the last pages is appended a chronological list of important world economic events from August, 1934, to July, 1935.—L. M. G.

Milk Production and Control. By W. C. Harvey and Harry Hill. H. K. Lewis & Co. Ltd., London, 1936. 636 pp., illus. Price, \$10.50.

This book is a welcome addition to dairy literature. As the title indicates, special attention is given to the different phases of production and control of milk. Although the book was specially written for present conditions in England, much can be learned from its chapters to help those directly connected with the production and distribution of milk and its supervision in any country.

The first chapter deals with the composition of milk and its food value and rightly serves as an introduction to the entire subject herein treated. The second chapter, Milk and Disease, discusses briefly the various diseases transmitted to man in milk. The authors mention several outbreaks to emphasize the importance of milk in its relation to human health. The chapters on the cow and the cow shed discuss briefly the proper care and housing of milk cows. Dairy equipment, actual milk production, and proper distribution are also discussed, with appropriate illustrations, in separate chapters.

A long chapter is devoted to the treatment of milk by heat. Here the different processes of pasteurization of milk and the problems connected with each process are discussed. Sterilization, sterilization, and irradiation of milk are also mentioned in this chapter. Another long chapter, devoted to laboratory and other control, is a good guide for students, health inspectors, and laboratory technicians connected with the inspection of milk.

In the chapters on designated milk and legislative control, the reader can easily follow the development of the dairy industry in Eng and

Milk Production and Control is not only a good guide or reference book for people concerned with the production and distribution of milk and government officials connected with milk inspection for whom the authors have written this work, but will also serve as a suitable textbook for classrooms.—S Y R

Labore Manum for Patients. By H. J. John. Second Edition. The C. V. Mosby Company, St. Louis. 1934. 232 pp. Price, \$2

In this little book the author tries "to present clearly and briefly what the person with diabetes should know about the disease and its treatment in order that he may, more fully and therefore more successfully cooperate with his physician." With this purpose in view the author explains the underlying laws and principles that corroborate or corroborate violation of which in some way or other produces the disease. He describes how it is acquired and the changes that take place in the body during the illness.

Since food plays an important role in the medical improvement of the patient, a good portion of this book is devoted to diet planned according to the modern trend of giving food more rich in carbohydrates. Thus the food values of different food products are given, the appendices being fully devoted to this purpose. The author also stresses the efficacy and necessity of insulin treatment, and unlike many physicians, encourages its use.

—I F

Who Shall Survive, a New Approach to the Problem of Human Interrelations. By J. L. Moreno. Washington: D. C. Nervous and Mental Disease Publishing Co. 1934. 437 pp. diagrs. Price \$4

Who Shall Survive deals with the study of the emotional relations among individuals who are functioning as a social group, or the cross-currents of emotion as they play back and forth between individuals. The material and illustrations are drawn from institutions and schools. The author develops a technique for a process of classification calculated to bring individuals together who are capable of harmonious interpersonal relationships, and creates a social group which can function at the maximum efficiency and with the minimum of disruptive tendencies and processes. He has rediscovered many homey truths by a different method which permits of their development to a more highly differentiated degree and also their utilization for the benefit of the individual. He differs from the psychoanalytic

approach in a significant way. While the analyst works backward to an explanation for the individual's conduct, he takes the individual's conduct as the starting point and works forward. All his various points of view, methods, and technique are of great significance. This is a good reference book on social problems.

—R. E. G.

The Student's Manual of Microscopic Technique, with Instructions for Photomicrography. By J. C. Tolosa. American Photographic Publishing Co., Boston, Mass., 1926. 210 pp., illus. Price, \$2.50.

This is a useful guide for students of anatomy and biology. It contains (a) a good chapter on the microscope, its care, uses, and the physical rationale of its operation, including the polarizing microscope, (b) another excellent chapter on the microscopic objects found in water and the modes of their examination, (c) several chapters on the commoner methods of preparing tissues for microscopic examination, including the principal procedures of sectioning, staining, etc., and their examinations microscopically in the fresh state and as permanent preparations, and (d) a special section on microphotography. Most of the principal topics are illustrated with excellent text figures.

The author has happily combined in one compact and convenient volume the principal methods of microscopic technique usually found in such standard works as Gage's, Lee's, Mallory and Wright's, and others. The book should have general acceptance as an excellent complement to ordinary textbooks of histology and pathology.—A. G.

Mountains and Earthquakes. By Harold Jeffreys. Methuen & Co. Ltd., London, 1925. 183 pp. Price, \$2.

This book gives a comprehensive discussion of the latest developments in the study of the earth from the view points of the physicist, the geologist, and the geodesist. The presentation is well planned, and the language, though precise, is simple. The subject is probably too far advanced for the comprehension of the layman, but it is very interesting to the technical man who has a good working knowledge of mathematics, physics, and geology.—Q. A. A.

The Mental Health Emphasis in Education—A Qualitative Study. By H. C. Patey and G. S. Stererson. The National Committee for Mental Hygiene, Inc., New York. 96 pp.

This treatise has for its working principle the idea that "basically the philosophy of mental hygiene and education are identical and may be stated in terms of complete living or satisfac-

tory functioning of the human organism." In terms of this principle it asserts that "at the present time the relationships of mental hygiene and education are confused by the fact that mental hygienists have given much of their attention to corrective therapy while educationalists have been concerned with fostering normal development without insight gained from observations of exaggerated functioning," and makes an effort to indicate methods of coördinating, articulating, and integrating the other agencies of society; namely, industry, business, law, social service, journalism, art, theology, and medicine, with education, in order for the latter "to realize all of the opportunities that lie within the scope of its own organization and objective." Perhaps too confident and optimistic, the authors claim that "the professional mental hygienist brings to each situation and interpretation intensive experience with the problems of individuals, with the purpose of bringing objectives to a focus in terms of what is most satisfying." A. V. C.

Elementary Microtechnique. By H. Alan Peacock. Edward Arnold & Co. London, 1935. 200 pp. Price, \$1.50.

This is an unassuming little book, which contains much useful information on microtechnic. It is intended primarily for beginners in histology and cytology, although advanced students equally will find the work a good reference book.

The book is introduced with a short summary of the structure of the cell and protoplasm, followed by brief descriptions of the processes of microtechnic. Chapters III and IV cover outlining methods and technic. There is an alphabetical list of special subjects with the various methods to be followed and their preparation in Chapter V; of stains and their uses in Chapter VI, and of formulas and hints in Chapter VII. Three appendices are included, the last being a bibliography.—M. T.

Sex Practice in Marriage. By C. H. S. Evans. Second Edition. Emerson Books, Inc., New York, 1935. 128 pp. Price, \$1.95.

This is a clear and simple exposition of a subject of vital interest to married couples and young people contemplating marriage who are seeking happiness. The book, which is so easy to read that it will but take few hours to finish, will not only help bring about a better understanding between husband and wife but also make for a better appreciation of each other's needs and problems. In serving as a guide in securing a happy mating, this book will help married people in solving their marital problems arising from ignorance of the proper functions

of sex, which will be conducive to harmony in the home, lessen friction, and minimize divorce. Likewise physicians will find the book a great help to their own method of handling related problems.—U. D. M.

Engineer-Custodians Manual. By Thomas J. Brett. American Technical Society, Chicago, 1934. 192 pp. \$2.50.

This is a useful book for building superintendents, engineers, custodians, firemen, electricians, and others interested in the operation and maintenance of public buildings. It embodies valuable information that is usually required for passing competitive civil-service examinations; contains over 500 questions and answers on boilers, combustion engines, heating and ventilating, air-conditioning, pumps, sanitation, plumbing, electrical machinery, and mechanics; over 200 engineering formulas and tables, and general information. The book is fully indexed.

—R. M.

Diesel and other Internal-Combustion Engines. By Howard E. Degler. American Technical Society, Chicago, 1936. 237 pp. Price, \$2.50.

This is practical text on the development, principles of operation, construction, details, and performance of stationary and portable diesel, gas, and gasoline engines.

In Part I the development and application, types, characteristics, efficiency, advantages, thermodynamics, and comparison of internal-combustion engines are set forth. Part II classifies fuels and fuel-air mixtures, gas producers, and liquid fuels and gives fuel-burning characteristics. Part III contains valuable information on automobile and aeroplane gas and gasoline engines. Part IV treats of low-pressure and moderate-pressure oil engines. Part V is devoted to heavy-duty diesel engines of various types. Part VI takes up high-speed diesel engines, their development and application. In Parts VII, VIII, IX, and X is found valuable information on diesel fuel-injection requirements and methods, engine parts, testing and testing methods, and economics of diesel power, respectively.—R. M.

Carpentry. By Gilbert Townsend. American Technical Society, Chicago, 1936. 430 pp. Price, \$2.

This book is a practical treatise on simple building construction, including framing, roof construction, general carpentry work, exterior and interior finish of buildings, building forms, and working drawings.

The book is adapted for use as a text in vocational, trade, high, and technical schools. It is an excellent text for home

study and reference for carpenters, apprentices, home owners, and anyone interested in building construction work.—R. M.

Air Conditioning and Engineering. By Engineering Staff of American Blower Corporation and Canadian Sirocco Co., Ltd. American Blower Corporation, Detroit, 1935. 691 pp. Price, \$5.

This is a treatise on the technic of conditioning and mechanical movement of air for the health and comfort of human beings and the efficiency of production in industry. It is a ready reference containing valuable data on air conditioning and engineering, including fundamental principles, laws, tables, sample calculations, and information relating to dimensions and capacities. In the apparatus and equipment section are found dimension and capacity tables and types of equipment used in actual practice. It is an excellent book for air-conditioning engineers.

—R. M.

A Guide to Sexing Chicks. By Charles S. Gibbs. Orange Judd Publishing Co., Inc., New York, 1935. 63 pp. Price, \$1.25.

The author is a research professor of veterinary science at the Massachusetts State College at Amherst. In his Guide to Sexing Chicks he describes the art which was first brought to light by Kiyoshi Masui and Juro Hashimoto of Tokyo Imperial University, and later put into practical application by Kojima and Sakagiyama. He mentions two schools of chick sexing, one depending upon the presence or absence of processes in the vent, and the other on the wrinkles of the mucous membrane of the cloaca.

Sexing chicks, as an art, requires skill, clear vision, rapid eye accommodation and ability to withstand bright light, steady hands, and nimble fingers. To the novice patient practice and mastery of its technic are necessary to attain a satisfactory degree of proficiency. The detailed description of the steps to be undertaken given in this book will be of practical value to him and other beginners.

The author suggests that sexing be done in bright day light or with the use of a 200-watt electric bulb, either blue or with frosted tip. The best time to sex is twelve hours after hatching or as soon as the chick has dried. A large process in the vent identifies a cockerel, and no process or a small one, a female. In actual identification a group of 5 per cent is confusing and may turn out one way or the other.—C. X. B.

The Medical Cookery Book. By Dorothy Stewart. J. Wright and Sons, Ltd., London, 1935. 136 pp. Price, \$1.25.

In the convalescent stage of many diseases in which drugs usually play an insignificant part, nourishment is more vitally important to the patient, since a suitable diet is more conducive to recovery. At this stage the consideration of proper foods becomes the concern of those whose responsibility it is to prescribe diet. The 300 recipes compiled in this book for making soup, salads, and other ideal foods for convalescents will provide the solutions to most of the problems concerning the right foods to give. The recipes have been thoroughly tested and are simple and economical. The book also contains much information on how the foods should be served, which suggestions increase its practical value.—A. J. H.

International Trade; Principles and Practices. By Paul V. Hearn. Prentice-Hall, Inc., New York, 1935. 723 pp. Price, \$5.

A comprehensive treatise on its subject, this book not only deals with the principles and practices of foreign trade, but also treats of its historical background and its legal aspects. Intended primarily as a textbook for use in colleges and universities, the book will be found useful by students and by those who are actually engaged in international trade. A lot of valuable information is given which the latter, especially, could use to advantage to broaden their knowledge of the aspects of oversea trade as a profession. The subject is discussed as a business calling, and also as an instrument of governments in their international relations with one another.

Chapters 5 and 6 deal with a graphical survey of international trade. Chapters 10 and 11 give a history of tariffs in general and of United States tariff in particular, and trace the evolution of international commercial policies from antiquity to the present. Thoroughly discussed in Chapters 17 and 18 are the subjects of foreign investments, foreign exchange, and the financing of foreign trade. The practical modus operandi of foreign business trade is likewise fully treated, just as the technique of foreign-trade promotion and advertising and the collection of foreign credits are ably presented.

Adding much to the usefulness of the book are the review questions, problems, and suggested references at the end of each chapter.

A typographical error in the chart on page 154 (Organization of the United States Customs) is evident, the territories under

the jurisdiction of the Secretaries of War and Navy having been interchanged.—A. de C.

Lancashire Sea-Fisheries Laboratory. James Johnstone Memorial Volume. University Press of Liverpool, 1934. 342 pp. Price, 21s.

The latest tendency in the cultured world in the way of honoring a scholar is the publication of a memorial volume giving evidences of the world's appreciation of his work. For this purpose the present volume was prepared to commemorate the death of James Johnstone and his retirement from the chair of Oceanography at Liverpool in 1935. It is a symposium on various matters dealing with the sea, including its physical and biological phenomena. It includes original investigations on varied oceanographic topics, written by men identified with various well-known schools of thought, both of Europe and America. The articles are independent from one another, and the only coördination among them is that they reflect the world to which Johnstone dedicated himself. In each article much useful information will be found by the oceanographer, the embryologist, the geologist, the ecologist, the parasitologist, and the physical chemist.—H. A. R.

Researches on Vitamins, 1900-1911. By Prof. Dr. G. Grijns. J. Noorduyn en Zoon N. V., Gorinchem, 1935. 254 pp.

This book was prepared to give evidence of the admiration and gratitude which the world owes Dr. G. Grijns for his valuable contributions to the science of vitamins. It is a compilation of his early works covering his investigations on polyneuritis gallinarum, with which is included his thesis on "the physiology of the nervous opticus," translated into German, and which was published while he was still a student at the University of Utrecht.

Doctor Grijns is largely to be remembered for his classical researches on beriberi. With his predecessor Eijkman, a fellow Dutchman, he is acknowledged as one of the founders of vitamin science. Considering the consequences of his investigation and the benefits which mankind reaped from them, Grijns deserves more of the world's gratitude than can be expressed by the preparation of this memorial volume.

The book, however, is more than a commemorative volume. In making the classical studies of the author accessible in English translation, the book commends itself to a large circle of readers, especially those who are making a historical study of vitamin science.—A. J. H.